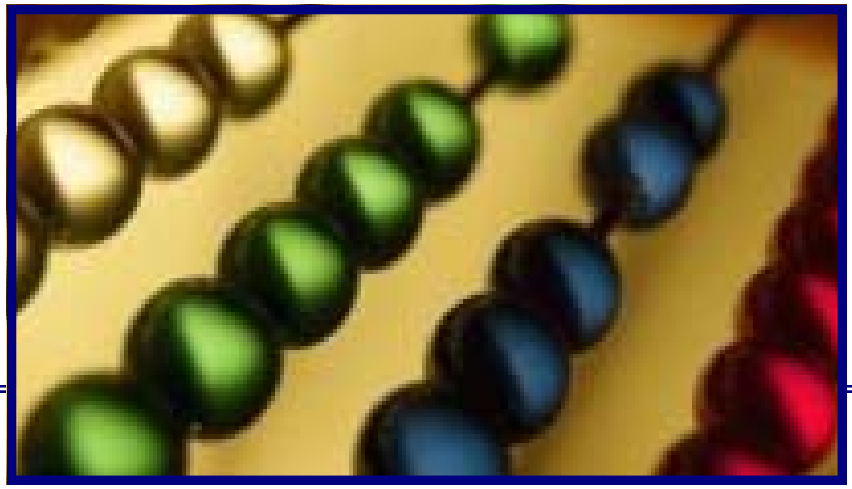

2002 Iowa Mathematics and Science Needs Assessment

A Study of Iowa Teachers, Superintendents, AEA Mathematics and Science Coordinators, and Higher Education Faculty

Mari Kemis, Tony Heiting, Judith Spitzli, and Evette Lang
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Research Institute for Studies in Education, Iowa State University
Iowa Department of Education

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Acknowledgements:

Marva Ruther Ellengray Kennedy
Robyn Johnson Kathy McKee

Research Institute for Studies in Education
E005 Lagomarcino Hall • Iowa State University • Ames, IA • 50011
Phone: 515-294-7009 • Fax: 515-294-9284
www.educ.iastate.edu/rise/

Iowa Department of Education
Grimes State Office Building
Des Moines, IA • 50319
Phone: 515-281-3249 • Fax: 515-242-6025
www.state.ia.us/educate/

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Introduction

The 2002 Iowa Mathematics and Science Needs Assessment is the third in a series of studies examining reform in mathematics and science in Iowa schools. In the past ten years, reform efforts in mathematics and science have included the advent of national standards and subsequent efforts to integrate these standards into curriculum and implement them in classrooms, many and varied opportunities for professional development of teachers so that they can teach to the standards, and shortages of teachers in both subject areas. Recent state (HF2272) and federal legislation (*No Child Left Behind*) raise new concerns about learning and teaching in mathematics and science, requiring educators at all levels to have accurate and credible information as they are making decisions. This 2002 study builds on the results of previous studies in 1992 and 1995 and looks to the future of mathematics and science education in Iowa.

Previous Studies—1992 and 1995

In 1992, an assessment of elementary and secondary curriculum needs and supply and demand for teachers in mathematics and science in Iowa was conducted[1]. At that time, over 600 secondary mathematics and science teachers,

[1] Sweeney, J., Kemis, M. R., Lively, M., & Sorensen, C. (1992, May). *An Assessment of Elementary and Secondary Curriculum Needs and Supply and Demand for Teachers in Mathematics and Science in Iowa*. Iowa State University: Research Institute for Studies in Education.

elementary teachers, and superintendents participated in a survey that (1) examined the supply of and demand for mathematics and science teachers in Iowa; (2) compiled information on how mathematics and science curricula were structured, when they were last revised, and familiarity with the new reform efforts in mathematics and science; (3) examined factors and possible strategies related to improving elementary and secondary mathematics and science education in Iowa; and (4) examined needs for professional development for mathematics and science teachers.

One year later in 1993, a statewide systemic initiative for reform in mathematics and science education was supported by the Iowa State Board of Regents, the Iowa Department of Education, the Dwight D. Eisenhower Mathematics and Science Education Act, and the Iowa Eisenhower Higher Education Grant. In this initiative, demonstration classrooms provided opportunities for teachers to improve their skills and the quality of instruction in mathematics and science. It was designed to recruit, train, and support teachers, administrators, schools, and school districts and demonstrate curricular changes, instructional strategies, and assessment methods consistent with the national reform efforts and emerging standards.

In 1995, in conjunction with this initiative, a second study was conducted to measure its impact, surveying 1600 Iowa mathematics and science teachers. The sample included teachers who had participated directly in the initiative, as well as following up with the teachers who had participated in the 1992 needs assessment[2]. In addition to the primary questions related to the impact of the demonstration classroom model, many items from the 1992 needs assessment were included. These items provided comparative information to examine

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[2] Kemis, M. R., Lively, M., Sorensen, C. & Sweeney, J. (1995, September). *Modeling Science and Mathematics Reform: Demonstration Classroom Model (Evaluation Report)*. Iowa State University: Research Institute for Studies in Education.
Note: 303 of the 478 teachers (63%) who participated in the 1992 needs assessment participated in the 1995 study.

changes in teacher knowledge of and attitude about reform efforts, types of reforms in mathematics and science implemented, application of skills and knowledge in K-12 classrooms, and whether reforms were successfully implemented.

Purpose of the 2002 Iowa Mathematics and Science Needs Assessment

The 2002 Iowa Mathematics and Science Needs Assessment was intended to provide the following:

- Data that indicate progress made in the level of awareness and implementation of national mathematics and science standards.
- Data that can be used by individual school districts to complete their own needs assessments.
- Data that address teacher quality and teacher shortage in mathematics and science.
- Data that can be used in improving teacher preparation programs.
- Data that provide information that supports applications for grants, such as mathematics and science partnerships.

In addition, the results of this study will assist school districts, Area Education Agencies (AEAs), higher education institutions, and the Iowa Department of Education in setting direction and focus in mathematics and science education that is aligned with legislative requirements and meets the needs of Iowa's school districts.

Methodology

The Iowa Department of Education contracted with the Research Institute for Studies in Education (RISE), College of Education at Iowa State University, to

conduct the 2002 Iowa Mathematics and Science Needs Assessment. RISE also conducted and reported the previously described 1992 needs assessment study and the 1995 evaluation study of the demonstration classroom model.

The 2002 study was conducted by mail survey during September and October 2002. Survey participants included teachers, superintendents, AEA mathematics and science coordinators, and selected higher education mathematics and science education faculty. Initial surveys were sent to 2052 individuals, along with (1) a letter from the Director of the Iowa Department of Education explaining the purpose of the survey and encouraging a response, (2) a note from RISE outlining information about confidentiality, voluntary participation (consent), and return deadlines, and (3) a business-reply envelope to return the completed survey to RISE. A second survey was sent to non-respondents approximately two weeks after the initial mailing, which increased the survey return rates. Appendix A contains the letters and notes described above.

Survey instruments were developed jointly by RISE personnel and Iowa Department of Education consultants in mathematics, science, and environmental education; and drafts were reviewed. The surveys conducted in 1992 and 1995 provided the basis for the 2002 teacher and superintendent surveys. In developing the four survey instruments, additional questions were constructed to address issues such as the effect of local standards and benchmarks on student achievement and instructional practices; understanding of new legislation; assessment; partnerships; environmental education; the role of the AEA; and teacher preparation and licensure. Common questions were included across the four surveys, when appropriate, for comparison among respondent groups. Appendix B contains copies of the four surveys used in this needs assessment.

A description of the sample and the survey instrument for each of these four groups follows. Information about the analysis of the data is also included in this section.

Survey of Teachers

Sample

A stratified random sample was used for the survey of teachers. The Iowa Department of Education provided the names and school addresses of secondary mathematics, secondary science, and elementary teachers employed during the 2001-2002 school year. The files were sorted by four enrollment categories, according to student population of (1) less than 1000, (2) 1000-2499 students, (3) 2500 to 7499 students, and (4) 7500 or more students. Within each of these categories, a random sample was selected to be representative of the enrollments of students statewide.

The sample of teachers consisted of 500 secondary mathematics teachers, 500 secondary science teachers, and 600 elementary teachers. The final sample size was 1564, taking into account 36 non-deliverable surveys. Overall, 49% of the teacher surveys were returned. Fifty-two percent of the secondary mathematics teachers returned surveys, while 47% of the secondary science teachers returned surveys. Surveys were returned by 47% of elementary teachers.

Table 1 details the percentage of student enrollment for the four categories, number and percentage of teachers selected by enrollment category, and number and percentage of surveys returned by enrollment category and teaching level.

Survey Instrument

The 2002 teacher survey included questions about curriculum revision and reforms; factors related to improving mathematics and science; preparation

Table 1. Return Rates for Teachers by Enrollment Category

	Number returned	*Number sent*	*Percent returned*
Elementary teachers			
< 1000	86	154	55.8
1000-2499	75	154	48.7
2500-7499	53	112	47.3
7500 or more	55	158	34.8
Mathematics teachers			
< 1000	79	132	55.9
1000-2499	67	129	51.9
2500-7499	56	99	56.6
7500 or more	56	132	42.4
Science teachers			
< 1000	69	135	51.1
1000-2499	62	127	48.8
2500-7499	39	98	39.8
7500 or more	63	134	47.0
Total	760	1564	48.6

of mathematics and science teachers; professional development needs for teachers; and opinions about likely strategies for addressing state initiatives and developing and enhancing alliances with other education partners. The 1992 and 1995 teacher surveys provided the basis for the 2002 teacher survey.

Survey of Superintendents

Sample

The sample of superintendents consisted of all superintendents at Iowa's 371 public schools. The names and school addresses of the superintendents were obtained from the Iowa Department of Education website (www.state.ia.us.gov). With non-deliverables and refusals, the final sample size was 366. Three hundred three superintendents returned surveys, for a final return rate of 83%.

Survey Instrument

The 2002 survey for superintendents replicated the questions asked in 1992, with slight modifications in format for clarity or to update questions, and

included several additional questions that examine current issues. The superintendent survey addressed issues related to teacher supply and demand, including the number of mathematics and science teachers needed in the next five years at the secondary, middle/junior high, and elementary levels; perceptions of anticipated difficulty in hiring teachers in specific subject areas; reasons for position vacancies; and how current reform efforts have affected hiring practices. Additionally, this survey focused on curriculum structure and revision, factors related to improving mathematics and science; and superintendent opinions about likely strategies for addressing state initiatives and developing and enhancing alliances with other education partners.

Survey of Area Education Agencies (AEA) Mathematics and Science Coordinators

Sample

AEA mathematics and science coordinators comprised the third survey respondent group. AEA mathematics and science coordinators provide professional development and resources to mathematics and science teachers within their area. The Iowa Department of Education provided names and addresses of current AEA coordinators. A map of the AEAs is included in Appendix C.

At some AEAs, one person may serve as a coordinator for both mathematics and science. Other AEAs may have more than one coordinator for mathematics or science. Twenty-eight AEA mathematics and science coordinators were asked to participate in the 2002 needs assessment. Twenty-six of the 28 surveys sent, representing all 15 AEAs, were returned (93%).

Survey Instrument

The survey for AEA mathematics and science coordinators contained questions about professional development for K-12 teachers; the role of AEAs in participating in state education initiatives; and their opinions about likely

strategies for addressing state initiatives and developing and enhancing alliances with other education partners.

Survey of Higher Education Faculty

Sample

Selected faculty members at Iowa's higher education institutions also were invited to participate in the 2002 needs assessment. The Iowa Department of Education provided names of mathematics and science education faculty at public and private colleges and universities and community colleges, indicating whether they specialized primarily in mathematics or science. Addresses were obtained from college or university websites. Responses were received from 43 of 54 university participants (80%). Table 2 summarizes the return rates for higher education faculty by institutional affiliation.

Table 2. Return Rates for Higher Education Faculty by Institutional Affiliation

	Number returned	*Number sent*	*Percent returned*
Public four-year	25	28	89.3
Private four-year	15	22	68.2
Two-year	2	3	66.7
Other	1	1	100.0
Total	43	54	79.6

Survey Instrument

The survey for higher education mathematics and science faculty focused on the adequacy of teacher education programs in mathematics and science; teacher licensure; professional development of K-12 teachers; and opinions about likely strategies for addressing state initiatives and developing and enhancing alliances with other education partners.

Summary of Survey Return Rates

The response to these surveys was high, particularly for superintendents, AEA mathematics and science coordinators, and higher education mathematics and science faculty. Table 3 summarizes the return rates for teachers, superintendents, AEA mathematics and science coordinators, and higher education faculty.

Table 3. Summary of Return Rates for All Respondents

	Number returned	*Number sent*	*Percent returned*
Teachers	760	1564	48.6
Superintendents	303	366	82.8
AEA mathematics and science coordinators	26	28	92.9
Higher education faculty	43	54	79.6

Data Analysis and Results

The data from the four surveys were analyzed in several ways. First, descriptive results are presented by topic area (topics to be described in the results section that follows). When appropriate, teacher responses were disaggregated by level/subject area (elementary, secondary mathematics, and secondary science) to allow for comparison of responses. Likewise, higher education responses were split to examine responses for mathematics and science faculty. Common items across respondent groups were analyzed and reported to examine similarities and differences. Second, on specified questions, differences by district size were examined. Third, selected teacher questions related to reform and leadership were examined by years of teaching experience. Finally, several questions that were asked of teachers and superintendents in 2002 were also asked in 1992 and 1995; the 2002 results will be compared to items that were common in 1992 and 1995.

The results of the 2002 Iowa Mathematics and Science Needs Assessment are presented by topic area. Within each topical area, relevant questions from any and/or all of the four surveys are included. The topic areas are:

- Teacher preparation and licensure
- Improving mathematics and science
- Teacher professional development
- Implementing reforms in K-12 classrooms in Iowa
- Integrating environmental education
- Assessment
- Use of technology
- AEA issues
- Teacher supply and demand
- Partnerships
- National initiatives—No Child Left Behind

It is important to know the needs of teachers, administrators, and higher education AEAs in addressing topic areas. These areas have been identified for the following reasons:

(1) They represent a cross-section of topic areas which have or are being given a strong emphasis due to national and/or state legislation (i.e., No Child Left Behind, Teacher Quality).

(2) Many of these topic areas were addressed in the 1992 trends survey. Comparative results can be made.

(3) The topics represent the areas addressed in the national mathematics and science standards.

Results for each topic area follow. Comparisons of 2002 data with 1992 and 1995 data and selected questions by district size are presented in separate sections.

Teacher Preparation and Licensure

Preparing teachers to have an understanding and working knowledge of the content and standards in mathematics and science is important in providing quality education. Teachers and higher education faculty responded to a set of questions related to preparation and licensure of teachers.

Opinions about Teacher Preparation

Teachers and higher education faculty were asked to report how adequately teachers are prepared to teach mathematics and science at the elementary and secondary levels. Higher education faculty reported their institutions' adequacy in preparing pre-service teachers in specific topic areas within mathematics and science.

Teachers were asked to indicate their perceptions of the overall preparation of mathematics and science teachers in their districts. The results are shown in Table 4. Over 80% of the teachers agreed or strongly agreed that high school teachers are well prepared to teach both mathematics and science (means of 5.27 and 5.29, on a six-point scale, respectively). About 72% of the teachers agreed that middle school/junior high teachers are well prepared to teach mathematics and science (means of 4.86 and 4.85, respectively).

Fewer teachers, however, agreed that elementary teachers are well prepared to teach mathematics and science. Fifty-five percent of the teachers agreed that elementary teachers are well prepared to teach mathematics. Secondary mathematics teachers were split about whether elementary teachers are well prepared to teach mathematics. Fewer than 40% agreed, while 35% of the secondary math teachers disagreed. Elementary teachers, however, were more confident about their preparation, with 71% agreeing that they are well prepared.

Table 4. Teachers' Perception of the Overall Preparation of Mathematics and Science Teachers

	Strongly disagree	*Disagree*	*Somewhat disagree*	*Somewhat agree*	*Agree*	*Strongly agree*	*Mean*	*S.D.*	*N of valid responses*	*Number don't know*
Elementary teachers in your district are well prepared to teach mathematics.										
All teachers	0.8%	6.4%	11.9%	26.1%	39.6%	15.1%	4.43	1.13	628	126
Elementary teachers	0.4%	2.3%	4.6%	21.8%	44.8%	26.1%	4.87	0.96	261	5
Mathematics teachers	1.9%	12.1%	20.5%	27.4%	31.2%	7.0%	3.95	1.20	215	43
Science teachers	0.0%	5.3%	12.5%	31.6%	42.8%	7.9%	4.36	0.98	152	78
Elementary teachers in your district are well prepared to teach science.										
All teachers	3.0%	10.2%	15.9%	34.7%	28.3%	8.0%	3.99	1.20	591	163
Elementary teachers	2.7%	5.4%	12.3%	33.8%	34.2%	11.5%	4.26	1.15	260	6
Mathematics teachers	2.8%	7.8%	17.7%	38.3%	27.0%	6.4%	3.98	1.13	141	117
Science teachers	3.7%	18.4%	19.5%	33.2%	21.1%	4.2%	3.62	1.23	190	40
Middle school/junior high teachers in your district are well prepared to teach mathematics.										
All teachers	1.4%	2.3%	7.2%	16.7%	42.4%	29.9%	4.86	1.08	622	127
Elementary teachers	0.0%	2.2%	3.2%	12.4%	50.3%	31.9%	5.06	0.88	185	79
Mathematics teachers	3.3%	2.1%	11.9%	20.2%	35.0%	27.6%	4.64	1.24	243	12
Science teachers	0.5%	2.6%	5.2%	16.5%	44.3%	30.9%	4.94	1.00	194	36

Rating scale: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree

Note that in all tables that mathematics teachers designates secondary mathematics teachers. Likewise, science teachers designates secondary science teachers.

Table 4. (continued)

	Strongly disagree	*Disagree*	*Somewhat disagree*	*Somewhat agree*	*Agree*	*Strongly agree*	*Mean*	*S.D.*	*N of valid responses*	*Number don't know*
Middle school/junior high teachers in your district are well prepared to teach science.										
All teachers	1.2%	2.6%	8.0%	16.3%	42.2%	29.8%	4.85	1.09	588	164
Elementary teachers	0.5%	3.3%	5.4%	12.5%	50.0%	28.8%	4.95	0.98	184	80
Mathematics teachers	2.2%	1.6%	11.4%	17.8%	38.9%	28.1%	4.74	1.16	185	71
Science teachers	0.9%	3.2%	7.3%	18.3%	38.4%	32.0%	4.86	1.10	219	13
High school teachers in your district are well prepared to teach mathematics.										
All teachers	0.3%	1.4%	3.2%	7.2%	42.0%	45.9%	5.27	0.88	629	115
Elementary teachers	0.6%	2.3%	3.4%	8.5%	46.9%	38.4%	5.14	0.94	177	83
Mathematics teachers	0.0%	1.6%	2.0%	6.4%	40.2%	49.8%	5.35	0.82	249	7
Science teachers	0.5%	0.5%	4.4%	6.9%	39.9%	47.8%	5.29	0.88	203	25
High school teachers in your district are well prepared to teach science.										
All teachers	0.3%	0.3%	3.3%	7.2%	43.9%	45.0%	5.29	0.81	613	135
Elementary teachers	1.1%	0.6%	4.0%	9.6%	45.2%	39.5%	5.16	0.93	177	85
Mathematics teachers	0.0%	0.5%	2.3%	5.9%	46.6%	44.7%	5.33	0.73	219	38
Science teachers	0.0%	0.0%	3.7%	6.5%	40.1%	49.8%	5.36	0.76	217	12

Table 4. (continued)

	Strongly disagree	*Disagree*	*Somewhat disagree*	*Somewhat agree*	*Agree*	*Strongly agree*	*Mean*	*S.D.*	*N of valid responses*	*N don't know*
Teachers in your district are well prepared to use instructional technology in teaching mathematics and science.										
All teachers	2.1%	8.0%	17.0%	34.2%	29.3%	9.3%	4.08	1.16	699	53
Elementary teachers	3.5%	7.4%	17.0%	35.2%	30.0%	7.0%	4.02	1.17	230	35
Mathematics teachers	1.2%	9.6%	16.1%	33.7%	28.9%	10.4%	4.11	1.16	249	8
Science teachers	1.8%	6.8%	18.2%	33.6%	29.1%	10.5%	4.13	1.15	220	10
Teachers in your district are well prepared to incorporate environmental education into their teaching.										
All teachers	2.3%	11.7%	17.2%	34.8%	27.8%	6.2%	3.93	1.17	647	103
Elementary teachers	2.7%	10.7%	13.3%	38.2%	27.1%	8.0%	4.00	1.18	225	37
Mathematics teachers	3.0%	16.3%	20.8%	30.2%	26.2%	3.5%	3.71	1.21	202	56
Science teachers	1.4%	8.6%	17.7%	35.5%	30.0%	6.8%	4.05	1.11	220	10

Even fewer teachers overall agreed that elementary teachers are well prepared to teach science (31%). Once again, elementary teachers were more confident in their preparation (45%), while only 25% of the secondary science teachers agreed. Forty-two percent of secondary science teachers disagreed that elementary teachers are well prepared to teach science.

Teachers were also asked if teachers are well prepared in the use of instructional technology in teaching mathematics and science and in incorporating environmental education. Approximately 40% of all teachers agreed and about one-third somewhat agreed that teachers in their districts are well prepared to use instructional technology. These percentages were consistent for elementary, secondary math, and secondary science teachers.

Finally, about one-third of teachers agreed that teachers in their districts are well prepared to integrate environmental education into their teaching. An additional one-third thought they are somewhat prepared, and another one-third disagreed.

Higher education respondents were asked several questions about teacher preparation programs at their respective colleges and universities. These questions included their opinions related to adequacy of preparation in mathematics and science, as well as how well they addressed specific topical areas.

Faculty at Iowa's higher education institutions were split in how adequately they prepared their elementary education majors to teach mathematics (Table 5). Over 60% of all faculty members responding reported that elementary education majors were adequately prepared to teach mathematics, although about 30% of the respondents reported inadequate preparation. Thirty-five percent of mathematics faculty reported inadequate preparation for elementary education majors.

The faculty respondents were more positive about preparation of mathematics education majors at the secondary level. Eighty-three percent of the

Table 5. Higher Education Faculty Opinions about Teacher Preparation Programs in Mathematics and Science

	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*S.D.*	*N*	*N don't know*
How adequately does your institution prepare elementary education majors to teach mathematics?									
All higher education respondents	5.4%	24.3%	8.1%	40.5%	21.6%	3.49	1.24	37	6
Higher education mathematics faculty	10.0%	25.0%	5.0%	50.0%	10.0%	3.25	1.25	20	0
Higher education science faculty	0.0%	18.8%	12.5%	31.3%	37.5%	3.88	1.15	16	6
How adequately does your institution prepare elementary education majors to teach science?									
All higher education respondents	0.0%	15.6%	12.5%	43.8%	28.1%	3.84	1.02	32	9
Higher education mathematics faculty	0.0%	0.0%	22.2%	55.6%	22.2%	4.00	0.71	9	9
Higher education science faculty	0.0%	22.7%	9.1%	36.4%	31.8%	3.77	1.15	22	0
How adequately does your institution prepare secondary mathematics education majors?									
All higher education respondents	0.0%	5.7%	11.4%	37.1%	45.7%	4.23	0.88	35	8
Higher education mathematics faculty	0.0%	10.0%	10.0%	35.0%	45.0%	4.15	0.99	20	0
Higher education science faculty	0.0%	0.0%	7.1%	42.9%	50.0%	4.43	0.65	14	8

Rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

faculty responding reported that teacher preparation programs provided adequate preparation. Ten percent of the mathematics faculty indicated that preparation at the secondary level was inadequate.

Over two-thirds of the faculty indicated that their institutions adequately prepared elementary education majors to teach science. Twenty-three percent of the science faculty reported inadequate preparation. A high percentage of mathematics faculty (78%) thought that there was adequate preparation for elementary education majors to teach science.

Mathematics faculty also responded to a question about how adequately their institutions addressed a series of topics in their teacher education programs (Table 6). They reported that the following topics were adequately addressed:

- NCTM content standards (mean=4.20 on a five-point scale)
- NCTM process standards (4.10)
- Special needs of students (3.59)

Over half of mathematics faculty indicated neutral or inadequate preparation at their institutions on closing the achievement gap (based on subgroups, i.e., ethnicity, social economic status). These mathematics faculty members were split regarding preparation on Iowa teaching standards. Over half (53%) indicated that this topic was adequately addressed, while 29% reported that it was inadequately addressed.

College and university science faculty reported that their institutions adequately prepared their secondary science education majors (Table 7). Adequacy was reported by approximately 90% of the science faculty in the following areas: chemistry (100%), biology (95%), physical science (95%), life science (95%), earth/space science (94%), and physics (89%). Although still high, a lesser percentage of higher education science faculty (71%) reported that their institutions were adequately preparing students in environmental science.

Higher education faculty also provided suggestions for improving the adequacy of preparation for science content areas. Their list follows.

Table 6. Higher Education Mathematics Faculty Opinions about their Institution's Adequacy in Addressing Mathematics Topics in their Teacher Preparation Programs

	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*S.D.*	*N*
Iowa teaching standards	0.0%	29.4%	17.6%	23.5%	29.4%	3.53	1.23	17
Special needs of students	0.0%	11.8%	29.4%	47.1%	11.8%	3.59	0.87	17
NCTM content standards	5.0%	5.0%	15.0%	15.0%	60.0%	4.20	1.20	20
NCTM process standards	5.0%	5.0%	20.0%	15.0%	55.0%	4.10	1.21	20
Closing the achievement gap	0.0%	6.3%	50.0%	37.5%	6.3%	3.44	0.73	16

Rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

Table 7. Higher Education Science Faculty Opinions about their Institution's Adequacy in Preparing Secondary Science Education Majors

	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*S.D.*	*N*
Biology	0.0%	5.3%	0.0%	26.3%	68.4%	4.58	0.77	19
Chemistry	0.0%	0.0%	0.0%	38.9%	61.1%	4.61	0.50	18
Physics	0.0%	5.6%	5.6%	27.8%	61.1%	4.44	0.86	18
Earth/space science	0.0%	6.3%	0.0%	50.0%	43.8%	4.31	0.79	16
Physical science	0.0%	0.0%	5.6%	38.9%	55.6%	4.50	0.62	18
Life science	0.0%	0.0%	5.0%	35.0%	60.0%	4.55	0.60	20
Environmental science	0.0%	17.6%	11.8%	35.3%	35.3%	3.88	1.11	17

Rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

- Less traditional instruction, more reform (toward modeling effective learning and teaching)
- [Provide] strong content background
- Have someone teaching environmental science who cares immensely about and has experience with environmental science
- Interdisciplinary instruction and research

Like the mathematics faculty, college and university science faculty responded to a question about the adequacy of their institutions addressing science topics in their teacher preparation programs (Table 8). They reported that their institutions were adequately addressing these science topics—National Science Education Standards (94%), inquiry-based learning (90%), Iowa teaching standards (89%), safety concerns in the classroom (75%), closing the achievement gap (75%), and the special needs of students (74%). Although 60% of the science faculty reported that their institutions adequately addressed improving reading and writing skills through science teaching, 15% thought it was inadequately addressed. Over half indicated that incorporating environmental education strategies into the curriculum was adequately addressed; 21% thought it was not.

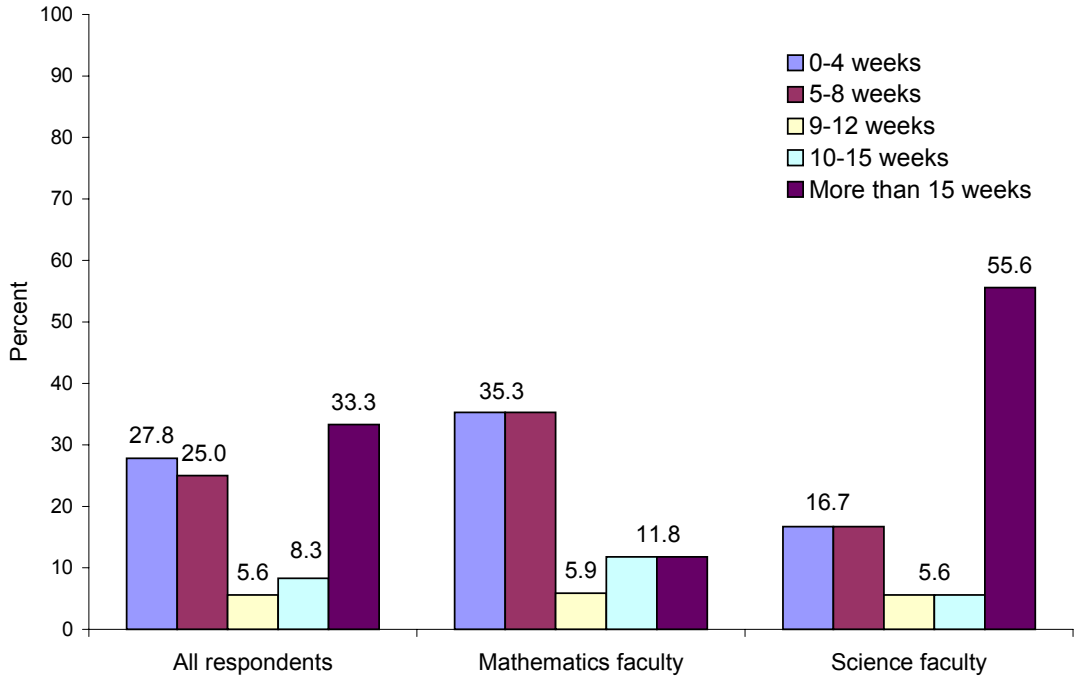
Higher education faculty also responded to a question about the amount of time that pre-service mathematics and science students spend in practicum experiences in addition to student teaching before completing their teacher preparation programs. (See Figure 1.) Most of the mathematics faculty (71%) reported that their students spend less than eight weeks in practicum experiences before completing their teacher preparation programs. About one-fourth of the mathematics faculty (24%) reported that their students spend more than 10 weeks. Conversely, a majority of science faculty (56%) reported that their students spend more than 10 weeks, with about one-third of those responding indicating that their students spend less than 8 weeks in practicum experiences.

Table 8. Higher Education Science Faculty Opinions about their Institution's Adequacy in Addressing Science Topics in their Teacher Preparation Programs

	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*S.D.*	*N*
Safety concerns in the lab/classroom	0.0%	5.0%	20.0%	50.0%	25.0%	3.95	0.83	20
Iowa teaching standards	0.0%	5.6%	5.6%	61.1%	27.8%	4.11	0.76	18
Special needs of students	0.0%	5.3%	21.1%	63.2%	10.5%	3.79	0.71	19
Inquiry-based learning	0.0%	10.5%	0.0%	26.3%	63.2%	4.42	0.96	19
National Science Education Standards	0.0%	5.6%	0.0%	33.3%	61.1%	4.50	0.79	18
Improving reading and writing skills through science teaching	0.0%	15.0%	25.0%	40.0%	20.0%	3.65	0.99	20
Closing the achievement gap	0.0%	6.3%	18.8%	62.5%	12.5%	3.81	0.75	16
Incorporating environmental education strategies into the curriculum	5.3%	15.8%	21.1%	47.4%	10.5%	3.42	1.07	19

Rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

Figure 1. Time Mathematics and Science Pre-Service Students Spent in Practicum Experiences--Responses by Higher Education Faculty



Finally, higher education mathematics and science faculty were asked to indicate whether the strength of their programs would change or stay the same over the next five years. More than half of the mathematics faculty (54%) thought the mathematics programs would be stronger, while 31% believed they would stay the same (Figure 2). The science faculty was not as positive as the mathematics faculty, with 40% indicating the science programs would be stronger (Figure 3). Thirty percent each saw the strength of the science programs as staying the same or decreasing.

For those who indicated that their teacher preparation programs will change over the next five years, faculty respondents wrote that positive changes in the mathematics programs will likely be attributed to curricular improvements, increased student interest, energetic and well qualified faculty, a new post-baccalaureate licensure program, a continual process of evaluation and improvement, and a willingness to change and adapt. They cited lack of

Figure 2. Higher Education Mathematics Faculty Perceptions of the Strength of the Mathematics Programs at their Institutions in the Next Five Years

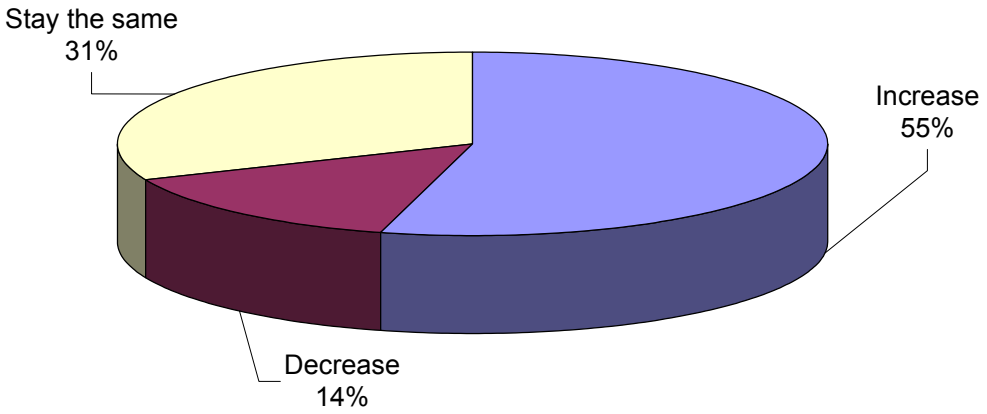
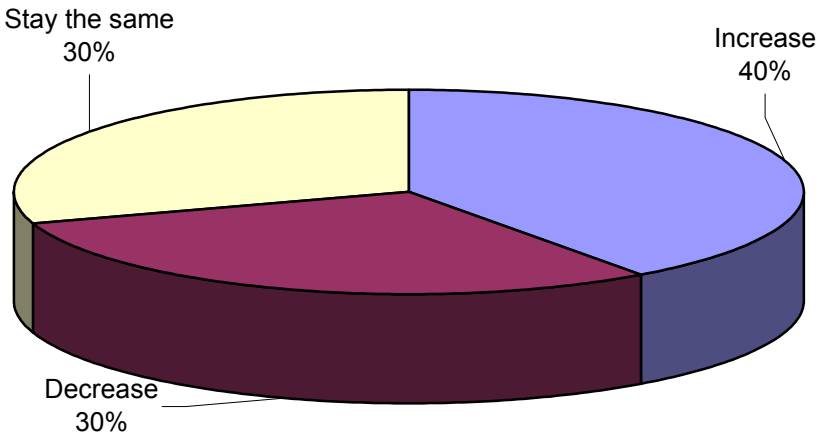


Figure 3. Higher Education Science Faculty Perceptions of the Strength of the Science Programs at their Institutions in the Next Five Years



funding, loss of faculty, and lack of support from college and university administration as reasons for weaker programs in the next five years.

Similar reasons were mentioned for changes in teacher preparation programs in science. Faculty respondents mentioned the addition of new courses (including new methods courses tied to intern experiences in local

schools), committed faculty, willingness to change and adapt, increased opportunities for undergraduate research, and strategic planning to explain stronger science programs. Budget cuts and loss of faculty due to retirements were suggested as explanations for science programs losing strength in the next five years.

In a related question, higher education faculty were asked if their institutions keep track of the number of mathematics and science teacher education graduates that leave Iowa after graduation. Over 50% of the mathematics faculty (56%) reported that they do, while 73% of science faculty indicated that they keep track of their graduates who leave the state.

Further, mathematics faculty who keep track believe that about 47% of their teacher education graduates in mathematics and science leave the state annually; their answers ranged from 20% to 70% of the graduates. A similar response was given by science faculty, who reported an average of 42% of their graduates leaving the state. Their responses ranged from 20% to 80%.

Opinions about Teacher Licensure

Teacher licensure is an important consideration within teacher preparation. Teachers and higher education faculty were asked several questions related to teacher licensure. First, they gave opinions about whether the current requirements for licensure in mathematics and science were sufficient for elementary, middle school, and high school teachers.

Elementary teachers that responded to these questions reported that licensure requirements in mathematics were sufficient for elementary teachers (84%), middle school teachers (82%), and high school teachers (80%). See Table 9 for details. Fewer secondary mathematics teachers indicated that licensure requirements were sufficient for elementary teachers (49%) and middle school teachers (57%). Most of secondary mathematics teachers believed that licensure requirements were sufficient for high school mathematics teachers (88%). It is

interesting to note that many elementary teachers indicated that they did not know whether licensure requirements were sufficient for middle and high school teachers. Similarly, 139 secondary mathematics teachers indicated that they did not know whether licensure requirements were sufficient for elementary teachers. (Only a few science teachers responded to this question; their responses are not reported here.)

In an open-ended question, teachers who responded made recommendations to address insufficient licensure requirements in mathematics. More classes, practica, and content preparation was most commonly suggested. These teachers recommended that elementary pre-service teachers need *better foundations in mathematics*, more methods classes, and experiences in "real" classrooms. Several recommended that elementary math specialists or elementary teachers should be required to take an emphasis in math.

Further, many respondents expressed concerned that *middle school teachers are frequently teaching math with little or no background*. Their suggestions included having a major or minor in mathematics to teach mathematics at the middle school/junior high level, math endorsement for middle school teachers, or more courses in math content. There were few comments regarding high school mathematics licensure. More than one teacher suggested that high school mathematics teachers have additional courses in pedagogy.

Unlike teachers, few mathematics faculty at Iowa's colleges and universities thought licensure requirements were sufficient for elementary (45%) and middle school (19%), and high school (39%) teachers (Table 9).

In an open-ended question, mathematics faculty made recommendations to address insufficient licensure requirements. Several faculty respondents noted a need for more mathematics content courses for elementary, including classes designed especially for the elementary level. One faculty respondent wrote that *students need 9-12 hours of mathematics, plus methods courses. Additionally, the 9-12 hours must be courses designed for them and with emphasis on reform*.

Table 9. Mathematics Teachers and Higher Education Mathematics Faculty Opinions Toward Current State Requirements for Licensure for Mathematics

	Are the current state requirements for licensure for mathematics sufficient for…								
	Elementary Teachers			*Middle School Teachers*			*High School Teachers*		
	% Yes	*N*	*N Don't Know*	*% Yes*	*N*	*N Don't Know*	*% Yes*	*N*	*N Don't Know*
Elementary teachers	83.6%	140	106	81.7%	60	179	79.6%	49	189
Mathematics teachers	22.0%	106	139	57.1%	161	87	88.4%	175	51
Higher education mathematics faculty	45.5%	17	3	18.8%	16	3	38.9%	18	1

Higher education respondents also mentioned that a *better definition of content* is needed for the secondary level, with *more specialized courses that are discipline-based, taught by math educators, emphasizing methodologies and learning theory*. They also suggested that *secondary teachers should have a capstone course (*[as suggested by] *MSEB guidelines) to help them pull together their math knowledge and be able to use it in teachin*g. Two respondents suggested dropping the middle school endorsement or making middle level certification consistent with national trends.

The results for science are similar to those for mathematics (Table 10). Elementary teachers that responded to these questions reported that licensure requirements in science were sufficient for elementary teachers (75%), middle school teachers (78%), and high school teachers (82%). As with mathematics, fewer secondary science teachers indicated that licensure requirements were sufficient for elementary teachers (53%). Most of secondary science teachers believed that licensure requirements were sufficient for middle school teachers (74%) and high school science teachers (94%).

Again many teachers may not have been familiar with licensure requirements at other levels. Elementary teachers indicated that they did not

Table 10. Science Teachers and Higher Education Science Faculty Opinions Toward Current State Requirements for Licensure for Science

	Are the current state requirements for licensure for science sufficient for…								
	Elementary Teachers			*Middle School Teachers*			*High School Teachers*		
	% Yes	*N*	*N Don't Know*	*% Yes*	*N*	*N Don't Know*	*% Yes*	*N*	*N Don't Know*
Elementary teachers	74.8%	119	108	77.8%	45	178	81.6%	38	183
Science teachers	53.0%	83	143	74.3%	136	90	93.5%	170	55
Higher education science faculty	31.6%	19	2	31.6%	19	2	57.9%	19	2

know whether licensure requirements were sufficient for middle and high school teachers; 143 secondary science teachers indicated that they did not know whether licensure requirements were sufficient for elementary teachers. (Only a few mathematics teachers responded to this question; their responses are not reported here.)

Like their counterparts in mathematics, few higher education science faculty thought licensure requirements were sufficient for elementary (32%) and middle school (32%) teachers. Conversely, more than half of the science faculty (58%) thought the licensure requirements for high school teachers were sufficient. In a related question, 79% of the higher education mathematics faculty and 71% of the science faculty indicated that state requirements for teacher licensure drive their teacher preparation programs in mathematics and science.

In the open-ended question regarding recommendations for addressing insufficient licensure requirements in science, science teachers suggested more content knowledge (particularly for the lower grades), classroom experiences prior to graduation (including hands-on experiences), age-appropriate science methods courses, and aligning curriculum to standards and benchmarks.

Higher education faculty respondents also made recommendations for addressing licensure requirements for science. They were similar to those recommended for mathematics, including more content, pedagogy, and practicum experiences. They suggested a broader science background for all K-6 teachers, with a focus on science courses designed especially for teachers.

Improving Mathematics and Science

Teachers, superintendents, and AEA coordinators offered opinions about improving mathematics and science. Teachers and superintendents examined the adequacy and importance of factors related to improving mathematics and science, and in particular, examined areas of need. Teachers provided their opinions about a number of possible strategies that could be used to improve mathematics and science education. Additionally, teachers, superintendents, and AEA coordinators wrote about the key issues related to teacher quality, teacher recruitment, and teacher retention. Their responses to these questions are summarized below.

Factors Related to Improving Mathematics and Science

Teachers and superintendents were asked to rate the adequacy and importance of several factors related to improving mathematics and science. These factors addressed funding; support from and communication with various educational partners; knowledge of reform efforts; opportunities for inservice, reflection, and sharing with peers; articulation; assessment; quality of instructional materials; use of technology; and participation by underrepresented groups. See Table 11 for their responses.

Teachers rated the following four factors as adequate (ratings above 3.5 on a 5.0 scale)—

Table 11. Adequacy and Importance of Factors Related to Improving Mathematics and Science--Teacher and Superintendent Responses

	Adequacy							*Importance*							
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	*Significant differences between adequacy and importance*
A Level of funding for science and mathematics (equipment, facilities, staff)															
All teachers	7.7%	37.4%	18.1%	30.8%	5.9%	2.90	740	1.8%	1.4%	13.1%	39.8%	43.9%	4.23	738	*
Elementary teachers	3.2%	33.6%	19.4%	34.4%	9.5%	3.13	253	2.7%	0.8%	11.7%	38.7%	46.1%	4.25	256	*
Mathematics teachers	7.5%	38.2%	18.9%	29.9%	5.5%	2.88	254	0.4%	2.4%	15.0%	45.1%	37.2%	4.16	253	*
Science teachers	12.9%	40.8%	15.9%	27.9%	2.6%	2.67	233	2.2%	0.9%	12.7%	35.4%	48.9%	4.28	229	*
Superintendents	6.0%	31.0%	16.0%	40.0%	7.0%	3.11	300	8.4%	0.0%	2.3%	36.9%	52.3%	4.25	298	*
B Leadership/assistance from universities															
All teachers	7.2%	28.7%	38.0%	22.6%	3.4%	2.86	676	1.7%	7.6%	35.2%	42.6%	12.8%	3.57	693	*
Elementary teachers	7.8%	28.9%	35.8%	23.4%	4.1%	2.87	218	2.2%	7.0%	38.3%	35.2%	17.4%	3.59	230	*
Mathematics teachers	8.1%	33.6%	36.2%	19.6%	2.6%	2.75	235	2.0%	10.2%	33.6%	45.1%	9.0%	3.49	244	*
Science teachers	5.8%	23.3%	42.2%	25.1%	3.6%	2.97	223	0.9%	5.5%	33.8%	47.5%	12.3%	3.65	219	*
Superintendents	10.2%	29.1%	39.3%	16.5%	4.9%	2.77	285	2.8%	8.0%	32.3%	45.1%	11.8%	3.55	288	*
C Leadership/assistance from AEAs															
All teachers	3.6%	15.5%	23.1%	43.1%	14.7%	3.50	743	2.0%	3.8%	20.4%	47.3%	26.5%	3.93	742	*
Elementary teachers	1.5%	12.7%	20.8%	45.2%	19.7%	3.69	259	1.5%	2.7%	16.1%	46.0%	33.7%	4.08	261	*
Mathematics teachers	3.1%	19.2%	25.1%	39.2%	13.3%	3.40	255	1.2%	4.3%	23.6%	46.9%	24.0%	3.88	254	*
Science teachers	6.6%	14.4%	23.6%	45.0%	10.5%	3.38	229	3.5%	4.4%	21.6%	49.3%	21.1%	3.80	227	*
Superintendents	3.4%	12.2%	14.4%	45.3%	24.8%	3.76	298	3.4%	1.7%	6.1%	42.2%	46.6%	4.27	296	*

Adequacy rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate
Importance rating scale: 1=very unimportant, 2=unimportant, 3=neutral, 4=important, 5=very important
*Mean importance ratings are significantly higher than mean adequacy ratings.

Table 11. (continued)

	Adequacy							*Importance*							
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	*Significant differences between adequacy and importance*
D Leadership/assistance from State Department of Education															
All teachers	9.8%	27.6%	41.2%	17.7%	3.7%	2.78	674	3.8%	8.2%	32.5%	38.3%	17.1%	3.57	707	*
Elementary teachers	7.8%	23.3%	47.9%	15.5%	5.5%	2.88	219	4.2%	7.2%	31.2%	34.6%	22.8%	3.65	237	*
Mathematics teachers	11.7%	29.2%	40.8%	15.4%	2.9%	2.69	240	3.3%	7.7%	35.4%	40.2%	13.4%	3.53	246	*
Science teachers	9.8%	30.2%	34.9%	22.3%	2.8%	2.78	215	4.0%	9.8%	30.8%	40.2%	15.2%	3.53	224	*
Superintendents	13.4%	34.2%	26.4%	24.3%	1.7%	2.67	292	2.1%	9.0%	20.8%	48.4%	19.7%	3.75	289	*
E Leadership/assistance from administrators in your building/district															
All teachers	3.7%	15.3%	18.0%	43.5%	19.5%	3.60	750	0.7%	3.1%	10.7%	38.5%	47.1%	4.28	749	*
Elementary teachers	2.7%	13.3%	14.1%	44.9%	25.1%	3.76	263	1.1%	2.3%	7.9%	35.7%	53.0%	4.37	266	*
Mathematics teachers	5.1%	17.2%	18.4%	43.8%	15.6%	3.48	256	0.4%	4.3%	11.7%	41.0%	42.6%	4.21	256	*
Science teachers	3.5%	15.6%	22.1%	41.6%	17.3%	3.54	231	0.4%	2.6%	12.8%	38.8%	45.4%	4.26	227	*
Superintendents	0.0%	2.7%	13.5%	52.5%	31.3%	4.12	297	2.4%	0.7%	3.4%	32.5%	61.0%	4.49	295	*
F Leadership/assistance from teachers in your building/district															
All teachers	0.8%	5.9%	12.0%	53.0%	28.2%	4.02	747	0.8%	0.9%	7.5%	42.0%	48.7%	4.37	747	*
Elementary teachers	1.1%	6.1%	10.2%	52.7%	29.9%	4.04	264	1.5%	0.8%	7.2%	41.3%	49.2%	4.36	264	*
Mathematics teachers	0.4%	8.6%	12.5%	52.1%	26.5%	3.96	257	0.4%	1.6%	7.0%	41.2%	49.8%	4.39	257	*
Science teachers	0.9%	2.7%	13.7%	54.4%	28.3%	4.07	226	0.4%	0.4%	8.4%	43.8%	46.9%	4.36	226	*
Superintendents	0.0%	2.3%	7.0%	45.3%	45.3%	4.34	298	1.4%	0.3%	0.7%	24.4%	73.2%	4.68	295	*

Table 11. (continued)

	Adequacy							*Importance*							
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	*Significant differences between adequacy and importance*
G Leadership/assistance from curriculum supervisors in your district															
All teachers	9.1%	21.6%	24.3%	29.7%	15.3%	3.21	691	2.0%	4.7%	19.5%	39.7%	34.1%	3.99	703	*
Elementary teachers	5.8%	17.3%	23.5%	32.9%	20.6%	3.45	243	2.0%	2.4%	16.5%	35.7%	43.4%	4.16	249	*
Mathematics teachers	12.2%	25.2%	24.3%	27.0%	11.3%	3.00	230	3.0%	4.6%	20.3%	44.7%	27.4%	3.89	237	*
Science teachers	9.6%	22.5%	25.2%	28.9%	13.8%	3.15	218	0.9%	7.4%	22.1%	38.7%	30.9%	3.91	217	*
Superintendents	0.4%	2.2%	21.6%	37.2%	38.7%	4.12	269	2.6%	0.4%	11.6%	25.1%	60.3%	4.40	267	*
H Knowledge about reform efforts in mathematics															
All teachers	2.9%	20.2%	26.6%	39.4%	11.0%	3.35	629	0.8%	4.3%	19.3%	46.8%	28.9%	3.99	654	*
Elementary teachers	4.6%	24.5%	23.6%	35.4%	11.8%	3.25	237	0.4%	2.0%	17.0%	44.9%	35.6%	4.13	247	*
Mathematics teachers	1.2%	18.9%	25.7%	43.8%	10.4%	3.43	249	0.4%	5.6%	16.5%	53.4%	24.1%	3.95	249	*
Science teachers	2.8%	15.4%	32.9%	38.5%	10.5%	3.38	143	1.9%	5.7%	27.2%	39.2%	25.9%	3.82	158	*
Superintendents	0.0%	12.4%	16.5%	53.3%	17.9%	3.77	291	0.3%	0.3%	5.5%	51.0%	42.8%	4.36	290	*
I Knowledge about reform efforts in science															
All teachers	4.2%	20.7%	23.8%	40.2%	11.1%	3.33	575	1.6%	3.4%	17.6%	47.0%	30.3%	4.01	613	*
Elementary teachers	6.1%	27.5%	22.3%	34.9%	9.2%	3.14	229	2.1%	2.1%	16.0%	46.5%	33.3%	4.07	243	*
Mathematics teachers	3.3%	17.9%	35.8%	37.4%	5.7%	3.24	123	2.7%	3.4%	24.7%	47.9%	21.2%	3.82	146	*
Science teachers	2.7%	15.2%	18.8%	47.1%	16.1%	3.59	223	0.4%	4.9%	14.7%	46.9%	33.0%	4.07	224	*
Superintendents	0.0%	13.5%	18.0%	50.9%	17.6%	3.73	289	0.3%	0.3%	6.2%	50.2%	42.9%	4.35	289	*

Table 11. (continued)

	Adequacy							*Importance*							
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	*Significant differences between adequacy and importance*
J Communication among educators, parents, community members, and business leaders															
All teachers	3.0%	18.0%	24.3%	42.3%	12.5%	3.43	738	0.9%	3.1%	14.7%	49.2%	32.1%	4.08	742	*
Elementary teachers	2.3%	15.2%	23.3%	42.8%	16.3%	3.56	257	0.8%	3.4%	11.9%	42.1%	41.8%	4.21	261	*
Mathematics teachers	3.2%	21.0%	25.8%	40.5%	9.5%	3.32	252	0.8%	3.9%	18.5%	49.6%	27.2%	3.98	254	*
Science teachers	3.5%	17.9%	23.6%	43.7%	11.4%	3.41	229	1.3%	1.8%	13.7%	56.8%	26.4%	4.05	227	*
Superintendents	2.0%	21.4%	26.4%	42.4%	7.8%	3.33	295	1.0%	2.0%	18.8%	52.9%	25.3%	3.99	293	*
K Involvement of parents, community members, and business leaders in reform efforts															
All teachers	5.8%	26.5%	35.3%	24.6%	7.8%	3.02	691	2.1%	8.7%	31.4%	36.6%	21.2%	3.66	713	*
Elementary teachers	5.2%	25.3%	29.3%	27.5%	12.7%	3.17	229	2.0%	7.7%	26.4%	35.0%	28.9%	3.81	246	*
Mathematics teachers	6.1%	29.8%	34.3%	24.9%	4.9%	2.93	245	2.0%	10.5%	29.6%	41.3%	16.6%	3.60	247	*
Science teachers	6.0%	24.0%	42.9%	21.2%	6.0%	2.97	217	2.3%	7.7%	39.1%	33.2%	17.7%	3.56	220	*
Superintendents	2.7%	22.0%	32.2%	37.3%	5.8%	3.21	295	2.1%	4.5%	26.8%	46.4%	20.3%	3.78	291	*
L Opportunities for teacher inservice activities in mathematics and science															
All teachers	8.0%	28.8%	15.6%	37.2%	10.4%	3.13	750	1.2%	3.6%	8.2%	49.2%	37.8%	4.19	748	*
Elementary teachers	7.2%	23.5%	12.9%	41.3%	15.2%	3.34	264	1.1%	4.9%	6.8%	44.2%	43.0%	4.23	265	*
Mathematics teachers	9.4%	32.4%	15.2%	35.9%	7.0%	2.99	256	1.2%	3.1%	9.4%	51.2%	35.2%	4.16	256	*
Science teachers	7.4%	30.9%	19.1%	33.9%	8.7%	3.06	230	1.3%	2.6%	8.4%	52.9%	34.8%	4.17	227	*
Superintendents	2.0%	14.5%	10.8%	52.7%	19.9%	3.74	296	2.4%	0.0%	2.4%	35.3%	60.0%	4.51	295	*

Table 11. (continued)

	Adequacy							*Importance*							
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	*Significant differences between adequacy and importance*
M Opportunities for teachers to reflect on own teaching															
All teachers	6.7%	22.5%	18.9%	41.3%	10.5%	3.27	750	1.1%	2.7%	10.4%	43.0%	42.8%	4.24	748	*
Elementary teachers	6.1%	21.3%	20.5%	38.0%	14.1%	3.33	263	1.5%	3.4%	9.1%	36.2%	49.8%	4.29	265	*
Mathematics teachers	7.4%	21.9%	20.3%	41.8%	8.6%	3.22	256	1.6%	2.0%	12.5%	46.9%	37.1%	4.16	256	*
Science teachers	6.5%	24.7%	15.6%	44.6%	8.7%	3.24	231	0.0%	2.6%	9.7%	46.7%	41.0%	4.26	227	*
Superintendents	4.0%	19.5%	16.1%	49.7%	10.7%	3.44	298	1.7%	0.3%	4.4%	41.3%	52.2%	4.42	293	*
N Opportunities for teachers to share ideas and strategies with peers															
All teachers	8.9%	28.6%	16.2%	34.4%	11.8%	3.12	752	1.2%	1.9%	7.9%	41.0%	48.0%	4.33	746	*
Elementary teachers	8.7%	26.1%	15.2%	33.0%	17.0%	3.23	264	2.3%	1.5%	8.7%	28.8%	58.7%	4.40	264	*
Mathematics teachers	9.0%	28.5%	18.8%	36.7%	7.0%	3.04	256	1.2%	2.3%	8.6%	48.0%	39.8%	4.23	256	*
Science teachers	9.1%	31.5%	14.7%	33.6%	11.2%	3.06	232	0.0%	1.8%	6.2%	47.3%	44.7%	4.35	226	*
Superintendents	3.0%	24.2%	13.4%	43.6%	15.8%	3.45	298	1.3%	0.0%	2.4%	43.8%	52.5%	4.46	297	*
O Articulation between levels (elementary, middle school/junior high, high school) in mathematics															
All teachers	10.2%	35.3%	18.0%	30.8%	5.6%	2.86	665	0.9%	2.6%	9.0%	45.4%	42.2%	4.25	699	*
Elementary teachers	10.0%	31.5%	18.7%	33.5%	6.4%	2.95	251	1.2%	2.3%	12.4%	48.3%	35.9%	4.15	259	*
Mathematics teachers	14.9%	37.8%	15.3%	26.5%	5.6%	2.70	249	1.2%	2.4%	5.6%	45.6%	45.2%	4.31	250	*
Science teachers	3.6%	37.6%	21.2%	33.3%	4.2%	2.97	165	0.0%	3.2%	8.9%	41.1%	46.8%	4.32	190	*
Superintendents	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Table 11. (continued)

	Adequacy							Importance							
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	*Significant differences between adequacy and importance*
P Articulation between levels (elementary, middle school/junior high, high school) in science															
All teachers	10.5%	33.3%	20.2%	30.6%	5.4%	2.87	589	0.5%	2.7%	11.3%	47.0%	38.6%	4.21	638	*
Elementary teachers	11.5%	32.0%	18.0%	31.1%	7.4%	2.91	244	1.2%	2.8%	13.0%	48.4%	34.6%	4.13	254	*
Mathematics teachers	12.7%	24.6%	31.4%	26.3%	5.1%	2.86	118	0.0%	1.3%	15.8%	44.3%	38.6%	4.20	158	*
Science teachers	8.4%	39.2%	16.7%	32.2%	3.5%	2.83	227	0.0%	3.5%	6.2%	47.3%	42.9%	4.30	226	*
Superintendents	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Q Use of multiple assessment measures (e.g., portfolios, authentic assessment, standardized tests, criterion-referenced tests)															
All teachers	3.7%	14.3%	25.4%	46.0%	10.6%	3.46	735	2.8%	6.9%	19.1%	46.1%	25.1%	3.84	742	*
Elementary teachers	4.3%	10.5%	19.8%	48.4%	17.1%	3.64	258	1.1%	3.0%	14.8%	43.2%	37.9%	4.14	264	*
Mathematics teachers	4.4%	18.3%	30.7%	40.6%	6.0%	3.25	251	4.4%	9.5%	23.8%	48.0%	14.3%	3.58	252	*
Science teachers	2.2%	14.2%	26.1%	49.1%	8.4%	3.47	226	3.1%	8.4%	19.0%	47.3%	22.1%	3.77	226	*
Superintendents	0.7%	14.5%	15.8%	46.8%	22.2%	3.75	297	2.4%	1.4%	7.4%	37.5%	51.4%	4.34	296	*
R Quality of instructional materials in mathematics (textbooks, media, and manipulatives, etc.)															
All teachers	2.6%	13.7%	15.9%	48.0%	19.8%	3.69	666	0.6%	1.3%	6.2%	44.2%	47.7%	4.37	694	*
Elementary teachers	2.6%	13.2%	12.1%	47.9%	24.2%	3.78	265	1.1%	0.0%	4.5%	34.7%	59.6%	4.52	265	*
Mathematics teachers	3.1%	14.2%	14.6%	50.8%	17.3%	3.65	254	0.4%	2.4%	4.4%	52.2%	40.6%	4.30	251	*
Science teachers	1.4%	13.6%	25.2%	43.5%	16.3%	3.60	147	0.0%	1.7%	11.2%	47.2%	39.9%	4.25	178	*
Superintendents	0.0%	8.4%	8.1%	58.6%	24.9%	4.00	297	1.4%	0.0%	2.4%	40.7%	55.6%	4.49	295	*

Table 11. (continued)

	Adequacy							Importance							
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	*Significant differences between adequacy and importance*
S Quality of instructional materials in science (textbooks, media, and manipulatives, etc.)															
All teachers	5.4%	15.7%	19.3%	44.4%	15.2%	3.48	611	0.9%	1.7%	6.6%	40.6%	50.2%	4.37	651	*
Elementary teachers	7.8%	17.2%	19.9%	40.2%	14.8%	3.37	256	1.5%	1.1%	5.4%	35.6%	56.3%	4.44	261	*
Math teachers	0.8%	10.4%	26.4%	44.8%	17.6%	3.68	125	0.6%	1.9%	11.7%	44.4%	41.4%	4.24	162	*
Science teachers	5.2%	17.0%	14.8%	48.7%	14.3%	3.50	230	0.4%	2.2%	4.4%	43.4%	49.6%	4.39	228	*
Superintendents	1.0%	7.4%	9.1%	59.5%	23.0%	3.96	296	1.0%	0.0%	1.7%	39.8%	57.5%	4.53	294	*
T Teacher awareness of the uses of instructional technology in mathematics and science															
All teachers	3.3%	24.7%	24.0%	40.1%	8.0%	3.25	729	0.7%	2.2%	15.5%	52.6%	29.0%	4.07	741	*
Elementary teachers	5.2%	31.2%	25.2%	32.8%	5.6%	3.02	250	0.8%	1.9%	19.4%	48.8%	29.1%	4.03	258	*
Mathematics teachers	2.8%	22.8%	22.8%	42.1%	9.4%	3.33	254	0.4%	3.1%	12.5%	57.6%	26.3%	4.06	255	*
Science teachers	1.8%	19.6%	24.0%	45.8%	8.9%	3.40	225	0.9%	1.3%	14.5%	51.3%	32.0%	4.12	228	*
Superintendents	2.0%	11.8%	14.8%	50.5%	20.9%	3.76	297	1.4%	0.3%	1.7%	40.3%	56.3%	4.50	295	*
U Availability of appropriate instructional technology in the classroom for teaching mathematics and science															
All teachers	6.2%	30.9%	22.9%	33.1%	6.9%	3.04	741	0.3%	4.0%	13.4%	51.9%	30.3%	4.08	745	*
Elementary teachers	7.8%	32.9%	24.7%	29.8%	4.7%	2.91	255	0.4%	3.4%	17.2%	48.5%	30.5%	4.05	262	*
Mathematics teachers	5.1%	29.4%	21.2%	37.3%	7.1%	3.12	255	0.4%	4.3%	12.2%	56.9%	26.3%	4.04	255	*
Science teachers	5.6%	30.3%	22.9%	32.0%	9.1%	3.09	231	0.0%	4.4%	10.5%	50.4%	34.6%	4.15	228	*
Superintendents	3.0%	17.2%	13.5%	47.3%	18.9%	3.62	296	1.7%	0.7%	3.0%	42.9%	51.7%	4.42	296	*

Table 11. (continued)

	Adequacy							*Importance*							
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	*Significant differences between adequacy and importance*
V Teachers' skills to utilize appropriate instructional technology in mathematics and science															
All teachers	4.6%	27.2%	23.3%	37.8%	7.2%	3.16	739	0.5%	3.0%	12.1%	53.7%	30.7%	4.11	745	*
Elementary teachers	6.6%	30.1%	27.0%	30.1%	6.3%	2.99	256	1.1%	3.8%	15.6%	46.6%	32.8%	4.06	262	*
Mathematics teachers	3.9%	25.6%	20.1%	41.7%	8.7%	3.26	254	0.0%	2.0%	9.8%	62.6%	25.6%	4.12	254	*
Science teachers	3.1%	25.8%	22.7%	41.9%	6.6%	3.23	229	0.4%	3.1%	10.5%	52.0%	34.1%	4.16	229	*
Superintendents	1.7%	17.5%	16.8%	47.5%	16.5%	3.60	297	1.7%	0.7%	1.7%	38.6%	57.3%	4.49	295	*
W Strategies for encouraging participation by underrepresented groups (females, minorities, disabled) in mathematics and science															
All teachers	3.9%	16.3%	29.7%	40.4%	9.8%	3.36	701	1.3%	4.2%	22.3%	43.7%	28.5%	3.94	716	*
Elementary teachers	5.9%	16.8%	28.6%	37.8%	10.9%	3.31	238	0.8%	3.6%	21.5%	40.6%	33.5%	4.02	251	*
Mathematics teachers	3.8%	17.1%	30.8%	37.5%	10.8%	3.35	240	2.5%	5.8%	23.2%	44.8%	23.7%	3.81	241	*
Science teachers	1.8%	14.8%	29.6%	46.2%	7.6%	3.43	223	0.4%	3.1%	22.3%	46.0%	28.1%	3.98	224	*
Superintendents	1.0%	14.7%	30.4%	45.1%	8.9%	3.46	293	2.1%	2.8%	19.3%	46.2%	29.7%	3.99	290	*

- leadership or assistance from teachers in their buildings or districts (mean=4.02)
- quality of instructional materials in mathematics (3.69)
- leadership or assistance from administrators in their buildings or districts (3.60)
- leadership or assistance from AEAs (3.50).

Superintendents differed from the teachers in that they reported considerably more factors they thought were adequate—

- leadership or assistance from teachers in their districts (4.34)
- leadership or assistance from administrators in their districts (4.12)
- leadership or assistance from curriculum supervisors in their districts (4.12)
- quality of instructional materials in mathematics (4.00)
- quality of instructional materials in science (3.96)
- knowledge about reform efforts in mathematics (3.77)
- leadership or assistance from AEAs (3.76)
- teacher awareness of the uses of instructional technology in mathematics and science (3.76)
- use of multiple assessment measures (3.75)
- opportunities for teacher inservice activities in mathematics and science (3.74)
- knowledge about reform efforts in science (3.73)
- availability of appropriate instructional technology in the classroom for teaching mathematics and science (3.62)
- teachers' skills in utilizing appropriate instructional technology in mathematics and science (3.60).

Teachers and superintendents were in close agreement that most of these factors were important. All factors received a rating above 3.5 on the 5.0 scale. In most cases, superintendents reported higher importance ratings than did the teachers. The following factors were rated 4.0 or higher on the 5.0 scale by teachers—

- leadership or assistance from teachers in their buildings or districts (4.37)
- quality of instructional materials in mathematics (4.37)
- quality of instructional materials in science (4.37)
- opportunities for teachers to share ideas and strategies with peers (4.33)
- leadership or assistance from administrators in their buildings or districts (4.28)
- level of funding for science and mathematics (4.23)
- articulation between levels in mathematics (4.25)
- opportunities for teachers to reflect on own teaching (4.24)
- articulation between levels in science (4.21)
- opportunities for teacher inservice activities in mathematics and science (4.19)
- teachers' skills in utilizing appropriate instructional technology in mathematics and science (4.11)
- communication among educators, parents, community members, and business leaders (4.08)
- availability of appropriate instructional technology in the classroom for teaching mathematics and science (4.08)
- teacher awareness of the uses of instructional technology in mathematics and science (4.07)
- knowledge about reform efforts in science (4.01).

The following factors were rated 4.0 or higher on the 5.0 scale by superintendents—

- leadership or assistance from teachers in their districts (4.68)
- quality of instructional materials in science (4.53)
- opportunities for teacher inservice activities in mathematics and science (4.51)
- teacher awareness of the uses of instructional technology in mathematics and science (4.50)
- quality of instructional materials in mathematics (4.49)
- leadership or assistance from administrators in their districts (4.49)
- teachers' skills in utilizing appropriate instructional technology in mathematics and science (4.49)
- opportunities for teachers to share ideas and strategies with peers (4.46)
- opportunities for teachers to reflect on own teaching (4.42)
- availability of appropriate instructional technology in the classroom for teaching mathematics and science (4.42)
- leadership or assistance from curriculum supervisors in their districts (4.40)
- knowledge about reform efforts in mathematics (4.36)
- knowledge about reform efforts in science (4.35)
- use of multiple assessment measures (4.34)
- leadership or assistance from AEAs (4.27)
- level of funding for science and mathematics (4.25).

A comparison of the adequacy and importance ratings shows interesting differences among groups. The means for all teachers combined, elementary teachers, mathematics teachers, science teachers, and superintendents were plotted to understand, in particular, which factors had lower adequacy ratings

along with corresponding higher importance ratings. Figures 4 through 8 show the details of which factors fall into each of four quadrants—low adequacy/low importance; high adequacy/low importance; low adequacy/high importance; and high adequacy/high importance. The quadrant containing factors with low adequacy/high importance indicates areas needing attention. [Note that the letters designating the factors are included in Table 11.]

All teachers combined reported factors related to level of funding for mathematics and science (A), leadership or assistance from universities (B) and the Iowa Department of Education (IDOE) (D), and articulation between levels in both mathematics and science (O, P) as areas of need. Elementary teachers also indicated needs related to leadership or assistance from universities (B) and the IDOE (D), articulation between levels in mathematics and science (O, P), availability of appropriate instructional technology in the classroom for teaching mathematics and science (U), and teachers' skills to utilize appropriate instructional technology in mathematics and science (V).

In addition to the factors mentioned for all teachers, mathematics teachers also saw needs related to involvement of parents, community members, and business leaders in reform efforts (K) and opportunities for teacher inservice activities (L). Science teachers gave similar responses as did all teachers (combined), as well as seeing a need for more involvement of parents, community members, and business leaders in reform efforts (K).

Superintendents reported only needs related to leadership or assistance from universities (B) and the IDOE (O). For the superintendents, all other factors fell into the high adequacy/high importance quadrant. No factors for any group fell into the low adequacy/low importance or high adequacy/low importance quadrants.

Figure 4. Comparison of Mean Ratings of Adequacy and Importance of Factors Related to Improving Mathematics and Science--Areas of Need Indicated by All Teachers

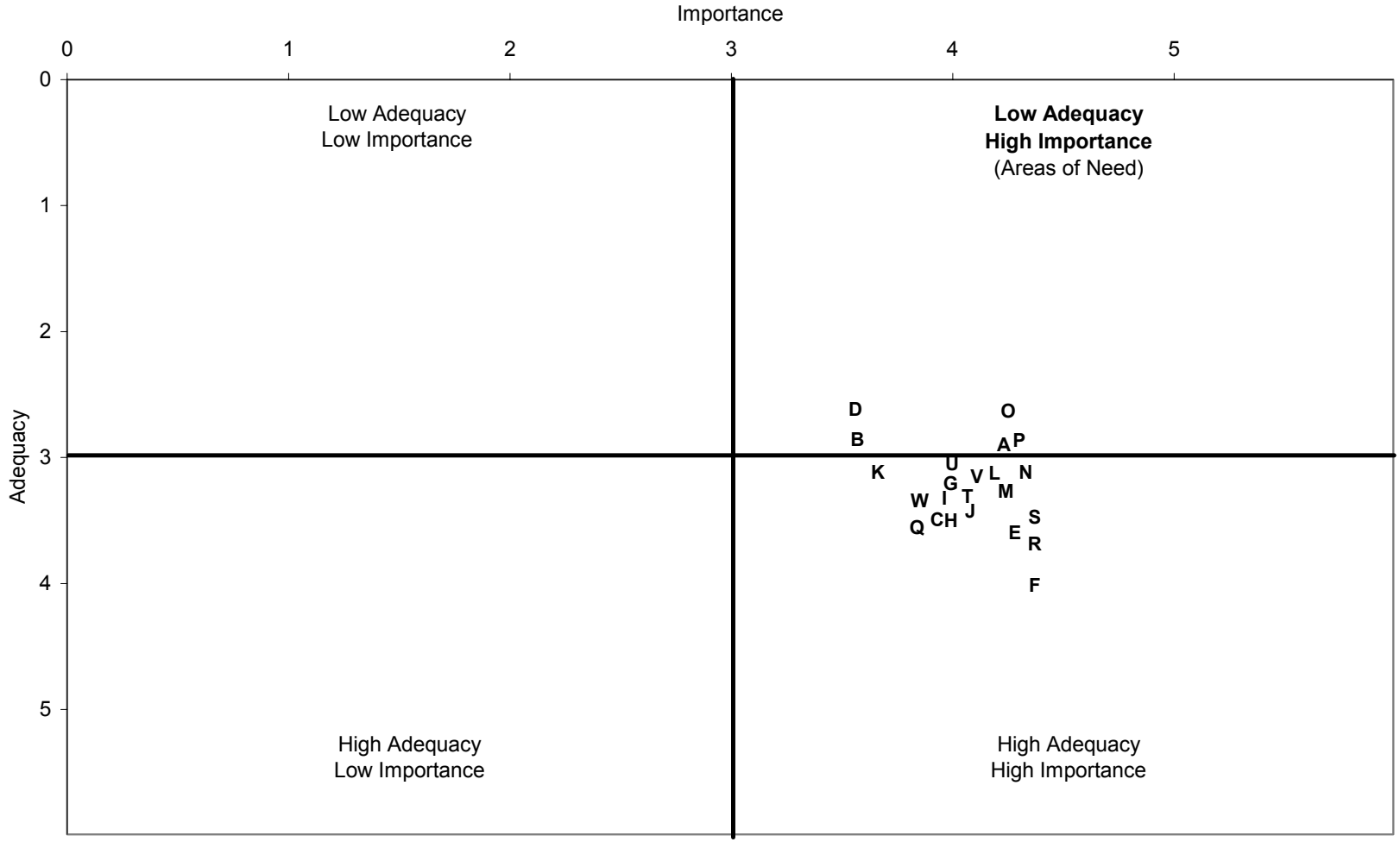


Figure 5. Comparison of Mean Ratings of Adequacy and Importance of Factors Related to Improving Mathematics and Science--Areas of Need Indicated by Elementary Teachers

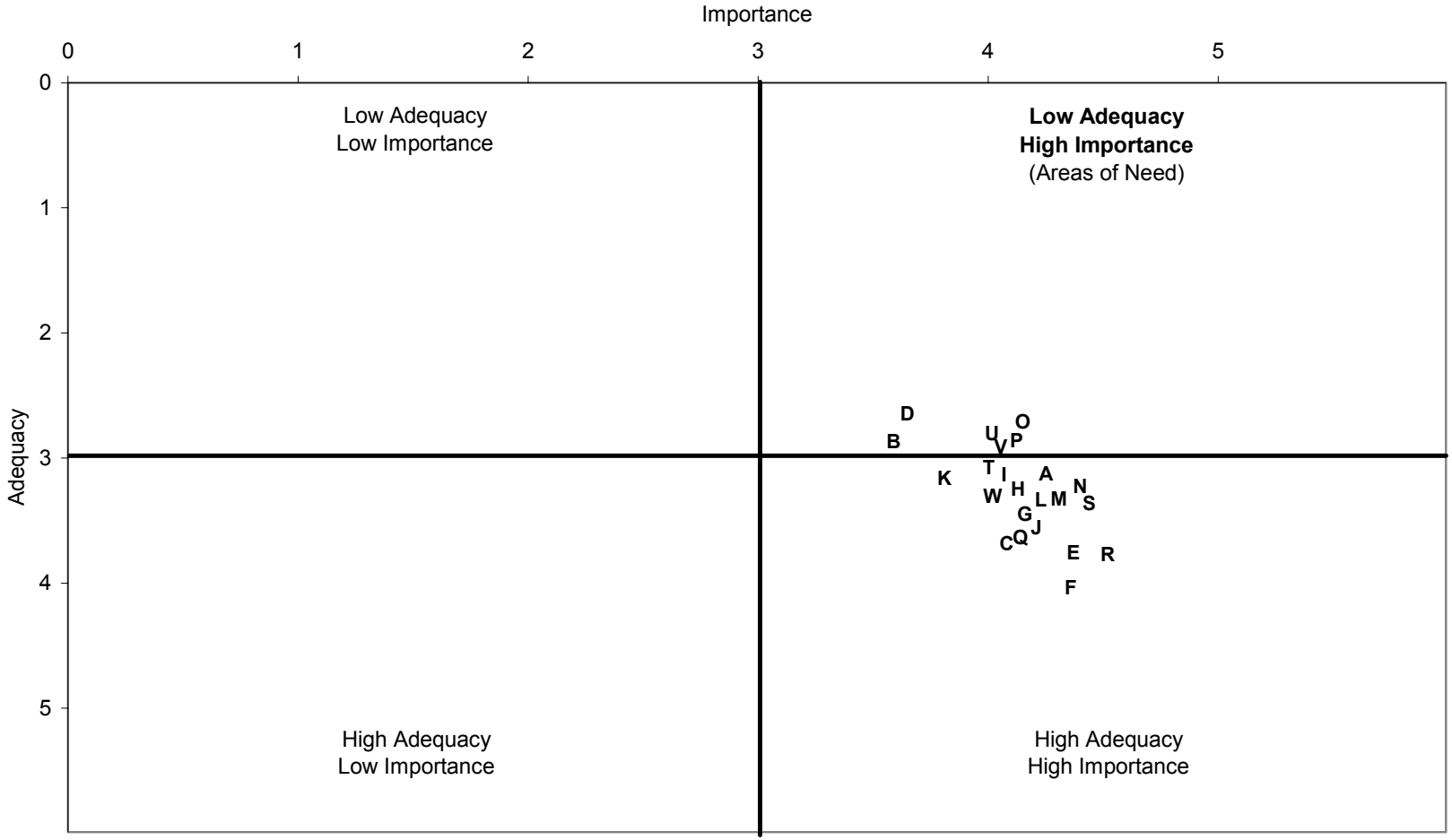


Figure 6. Comparison of Mean Ratings of Adequacy and Importance of Factors Related to Improving Mathematics and Science--Areas of Need Indicated by Mathematics Teachers

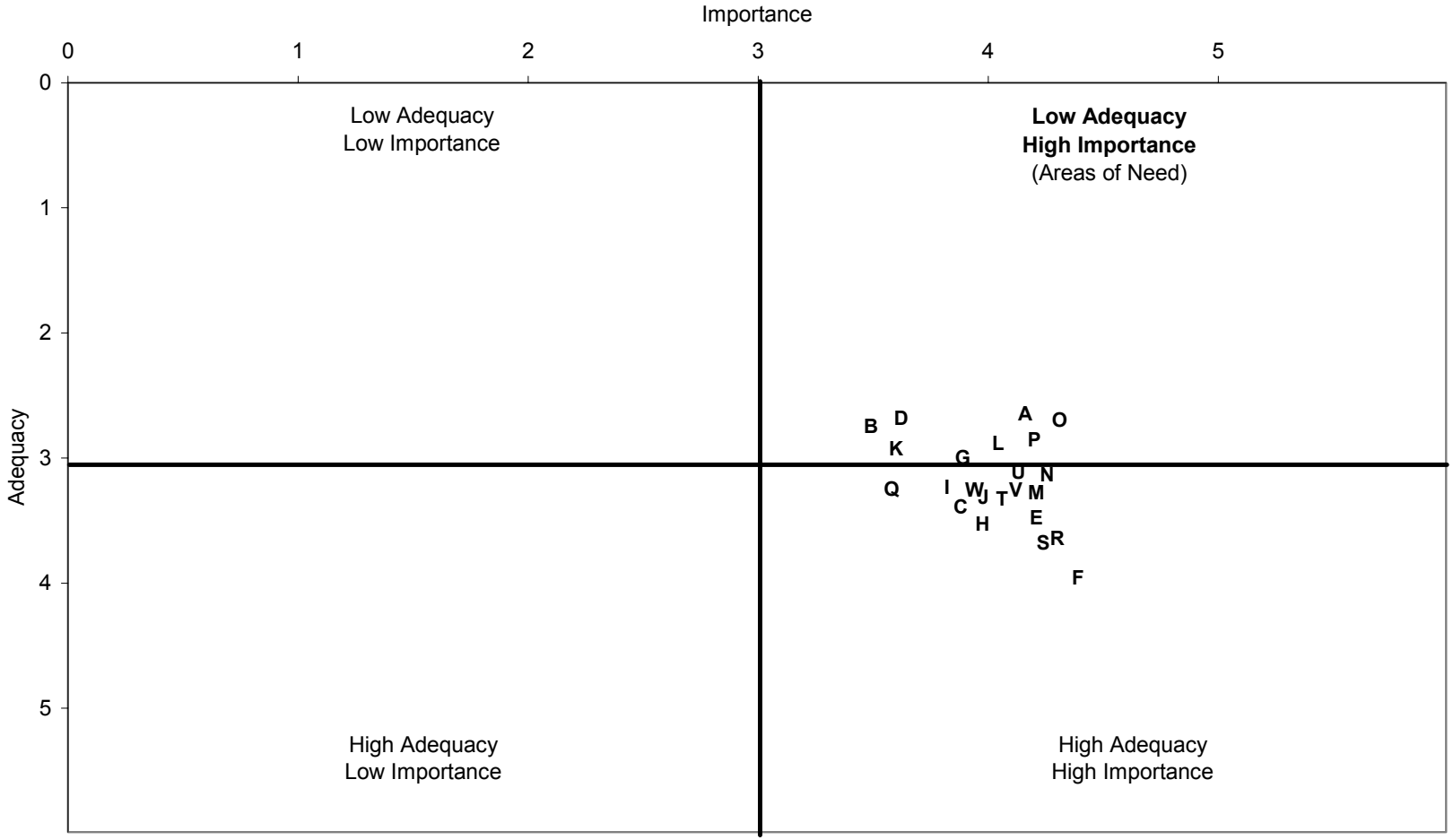


Figure 7. Comparison of Mean Ratings of Adequacy and Importance of Factors Related to Improving Mathematics and Science--Areas of Need Indicated by Science Teachers

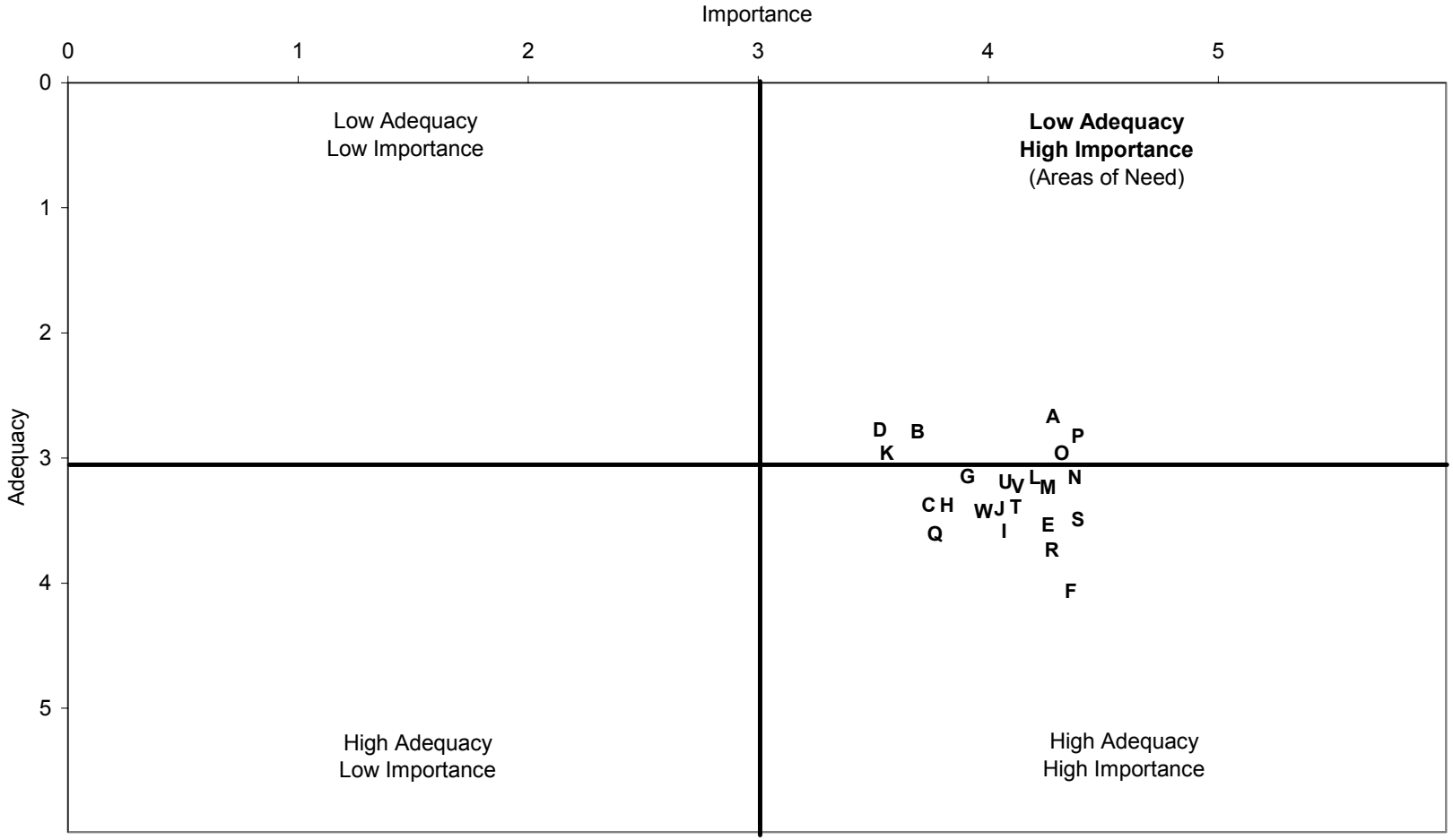
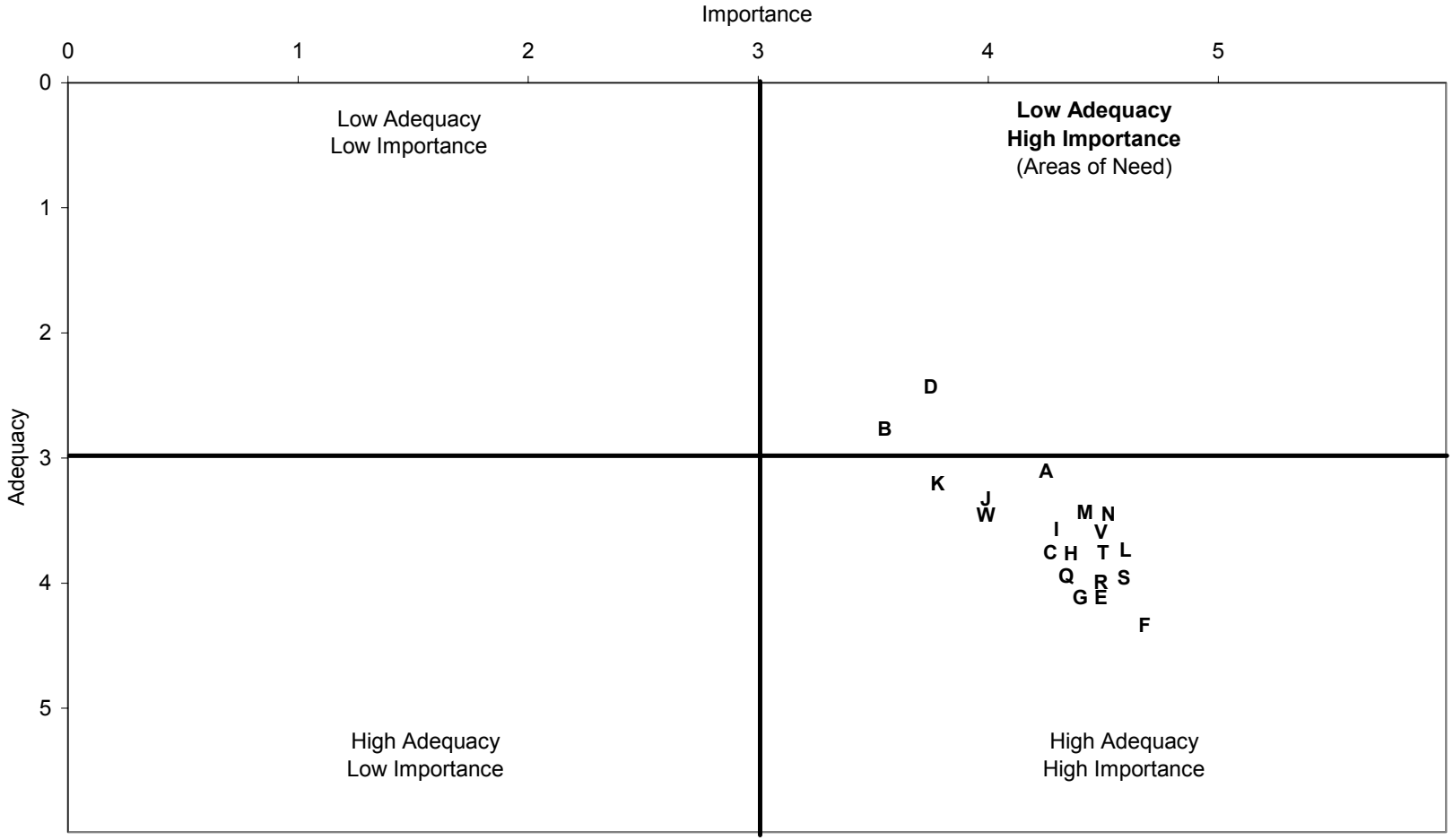


Figure 8. Comparison of Mean Ratings of Adequacy and Importance of Factors Related to Improving Mathematics and Science--Areas of Need Indicated by Superintendents



Possible Strategies for Improving Mathematics and Science Education

Teachers also were asked to rate several possible strategies for improving mathematics and science education. Their responses are summarized in Table 12. Overall, teachers agreed that additional funding for equipment, facilities, and staff was needed. They also indicated that teachers needed more opportunities to participate in inservice activities in their subject areas. Although a larger proportion of elementary teachers than other teachers disagreed, teachers, in general, reported that increased instructional time in mathematics and science at the elementary level and requiring elementary teachers to take more mathematics and science courses at the undergraduate level would improve math and science education. Additionally, forming partnerships with universities and the private sector was seen as a good way to enhance mathematics and science programs. However, teachers reported that partnerships with the private sector and universities that could provide things like donated equipment, resource people, mentor programs, or special projects often did not exist in their districts.

Key Issues in Teacher Quality, Recruitment, and Retention in Mathematics and Science

Three of the respondent groups, teachers, superintendents, and AEA mathematics and science coordinators, responded to the following question, *"From your perspective, what are the key teacher quality and/or teacher recruitment and retention issues that need to be addressed in science and mathematics?"*

Five overall themes emerged as key issues relating to teacher quality, recruitment and retention—(1) salary and funding; (2) content knowledge and teaching strategies; (3) resources; (4) environment, government relations, and support; and (5) the unique challenges of rural and small school districts. Issues related to salary and funding focuses on pay, funding, and incentives for those teaching mathematics and science. Content knowledge and teaching strategies

Table 12. Teachers' Opinions on Possible Strategies to Improve Mathematics and Science Education

	Stronly disagree	*Disagree*	*Somewhat disagree*	*Somewhat agree*	*Agree*	*Strongly agree*	*Mean*	*S.D.*	*N*
A State Clearinghouse for the dissemination of information on all local, state, and national science and mathematics education programs and activities is needed in Iowa.									
All teachers	4.6%	11.6%	12.9%	40.2%	24.4%	6.3%	3.87	1.22	743
Elementary teachers	3.1%	14.0%	15.6%	40.5%	21.0%	5.8%	3.80	1.19	257
Mathematics teachers	3.9%	12.1%	13.6%	39.3%	25.3%	5.8%	3.88	1.20	257
Science teachers	7.0%	8.3%	9.2%	41.0%	27.1%	7.4%	3.95	1.28	229
Partnerships with the private sector are a good way to enhance mathematics and science programs in your school district.									
All teachers	1.7%	4.8%	12.5%	37.1%	35.4%	8.5%	4.25	1.05	752
Elementary teachers	1.9%	4.5%	13.3%	32.6%	37.1%	10.6%	4.30	1.09	264
Mathematics teachers	1.6%	5.4%	11.7%	40.9%	35.0%	5.4%	4.19	1.01	257
Science teachers	1.7%	4.3%	12.6%	38.1%	33.8%	9.5%	4.26	1.05	231
Partnerships with universities are a good way to enhance mathematics and science programs in your school district.									
All teachers	0.8%	3.1%	8.5%	34.2%	41.4%	12.0%	4.48	0.97	749
Elementary teachers	0.0%	2.3%	9.1%	29.7%	42.6%	16.3%	4.62	0.94	263
Mathematics teachers	1.6%	4.7%	8.6%	38.3%	40.2%	6.6%	4.31	1.00	256
Science teachers	0.9%	2.2%	7.8%	34.8%	41.3%	13.0%	4.53	0.95	230
Partnership with the private sector (e.g., donated equipment, resource people) in mathematics and science often exists in your school district.									
All teachers	13.2%	29.1%	20.8%	25.2%	9.0%	2.7%	2.96	1.29	742
Elementary teachers	10.8%	27.0%	20.5%	25.9%	11.6%	4.2%	3.13	1.34	259
Mathematics teachers	18.4%	31.4%	22.7%	21.2%	5.1%	1.2%	2.67	1.21	255
Science teachers	10.1%	28.9%	18.9%	28.9%	10.5%	2.6%	3.09	1.00	228

Agreement rating scale: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree

Table 12. (continued)

	Stronly diagree	*Disagree*	*Somewhat disagree*	*Somewhat agree*	*Agree*	*Strongly agree*	*Mean*	*S.D.*	*N*
Partnerships with the universities (e.g., mentor programs, special projects) in mathematics and science often exist in your school district.									
All teachers	15.8%	29.7%	21.5%	22.3%	7.9%	2.8%	2.85	1.30	748
Elementary teachers	13.4%	31.8%	18.0%	23.8%	8.0%	5.0%	2.96	1.37	261
Mathematics teachers	20.4%	27.5%	22.7%	22.0%	6.7%	0.8%	2.69	1.25	255
Science teachers	13.4%	29.7%	24.1%	21.1%	9.1%	2.6%	2.91	1.28	232
Increased instructional time in the areas of mathematics and science at the elementary levels would improve mathematics and science education in your district.									
All teachers	1.6%	4.6%	9.5%	33.0%	30.3%	20.9%	4.49	1.15	745
Elementary teachers	3.0%	9.1%	15.5%	35.2%	26.1%	11.0%	4.05	1.22	264
Mathematics teachers	0.8%	2.7%	5.1%	31.8%	32.5%	27.1%	4.74	1.05	255
Science teachers	0.9%	1.3%	7.5%	31.9%	32.7%	25.7%	4.71	1.03	226
Requiring elementary teachers to take more mathematics and science at the undergraduate level would improve math and science education.									
All teachers	1.9%	7.4%	9.8%	36.5%	27.1%	17.4%	4.32	1.20	748
Elementary teachers	3.4%	13.3%	15.2%	42.4%	17.8%	8.0%	3.82	1.21	264
Mathematics teachers	1.2%	5.5%	9.4%	31.3%	32.0%	20.7%	4.50	1.15	256
Science teachers	0.9%	2.6%	3.9%	35.5%	32.5%	24.6%	4.70	1.02	228
Requiring secondary teachers to take more mathematics and science methods courses at the undergraduate level would improve math and science education.									
All teachers	3.1%	9.6%	13.0%	34.8%	26.5%	13.0%	4.11	1.25	747
Elementary teachers	3.1%	8.1%	11.2%	39.0%	25.9%	12.7%	4.15	1.21	259
Mathematics teachers	2.3%	14.1%	16.0%	29.7%	25.4%	12.5%	3.99	1.30	256
Science teachers	3.9%	6.5%	11.6%	35.8%	28.4%	13.8%	4.20	1.24	232

Table 12. (continued)

	Stronly diagree	*Disagree*	*Somewhat disagree*	*Somewhat agree*	*Agree*	*Strongly agree*	*Mean*	*S.D.*	*N*
Adding environmental strategies is a way to strengthen curriculum and improve student achievement.									
All teachers	3.0%	7.6%	18.4%	40.7%	21.4%	8.9%	3.97	1.15	739
Elementary teachers	2.7%	3.4%	15.7%	41.4%	26.4%	10.3%	4.16	1.09	261
Mathematics teachers	3.2%	11.3%	23.5%	42.1%	15.0%	4.9%	3.69	1.11	247
Science teachers	3.0%	8.2%	16.0%	38.5%	22.5%	11.7%	4.04	1.21	231
My district needs additional funding for science and mathematics (equipment, facilities, staff).									
All teachers	0.1%	2.1%	5.2%	18.4%	30.9%	43.2%	5.07	1.02	748
Elementary teachers	0.4%	2.3%	6.1%	16.4%	32.1%	42.7%	5.06	1.05	262
Mathematics teachers	0.0%	3.1%	7.0%	19.1%	32.4%	38.3%	4.96	1.07	256
Science teachers	0.0%	0.9%	2.2%	20.0%	27.8%	49.1%	5.22	0.90	230
Teachers in my district need more opportunities to participate in inservice activities in mathematics and/or science.									
All teachers	0.7%	2.8%	7.0%	26.5%	32.8%	30.3%	4.79	1.08	748
Elementary teachers	0.4%	1.9%	8.7%	27.4%	30.8%	30.8%	4.79	1.06	263
Mathematics teachers	0.4%	3.5%	6.6%	27.3%	31.3%	30.9%	4.78	1.09	256
Science teachers	1.3%	3.1%	5.2%	24.5%	36.7%	29.3%	4.80	1.09	229

included issues addressing the need for increased content knowledge, sound pedagogy, professional development, strong undergraduate training and teacher preparation, the use of multiple teaching strategies and effective teaching methods, and incorporation of standards and benchmarks. Issues relating to resources were equipment needs, time constraints, and workload. Environment, government relations, and support included comments related to mentors; collaboration; classroom management and safe environments; teacher retirement and attrition; certification/licensure requirements, government guidelines, and increased paperwork; and support of administrators, parents, and legislators. The final theme related to the unique challenges of rural and small school districts.

Teachers were most concerned about low salaries for teachers. However, as a group, many voiced that quality and competence in the content knowledge and teaching strategies and methods should be addressed. More specifically, support from administrators and parents, as well as teacher expertise and knowledge, mentors, and collaboration were issues that could improve quality, recruitment, and retention for teachers. It was also pointed out that better teacher preparation and college training; understanding of multiple strategies, assessments, and teaching methods; and training in standards and benchmark implementation would also improve quality, recruitment, and retention of teachers. Under the theme of resources, lack of time and class size emerged as a specific concern of teachers in addition to the need for equipment and technology. Quotes that represent the views of the teachers follow:

> *Multiple strategies for all types of learners need to be ingrained.*
>
> *Key issue is teacher expertise in each area.*
>
> *Teachers need to be provided with equipment and have time to set up experiments.*

Many good math and science personnel are going with the private sector where their knowledge will be financially rewarded.

Handling behavior problems is beginning to take first place. You can have knowledge and teaching strategies, but if you don't have class control, you can't teach!

Teachers need to have a good background in science/math, they need to know how to teach…and be given lots of opportunities to practice before going out on their own, they need support…adequate supplies…be well paid or they will go into industry.

Knowledge of subject matter, experience with pedagogy of teaching, mentoring new teachers, time to reflect and discuss successes or failures.

Not enough planning time to prepare the science activities.

Time to develop and align curriculum with standards and benchmarks.

The superintendents who responded overwhelming sited salaries and funding, in general, as the major teacher quality, recruitment, and retention issues. In addition, the need for additional incentives for math and science teachers in order to compete with industry pay standards emerged as a common suggestion by superintendents. Several superintendents also mentioned content knowledge, mentors and collaboration, support at the undergraduate training and teacher preparation level, and government guidelines, paperwork, and certification requirements as important issues. The following quotes express the view of the majority of the superintendents.

I believe…some of the best teachers…[are] *coming* [out of] *our colleges and universities in 25 years…*[we] *just can't keep them with the salary schedule…and the "challenges" teachers face everyday from parents and kids.*

Teacher pay, financial incentives, bonus for math and science areas.

Funding for salaries to attract and keep teachers.

All educational entities must work together to bring new methodology to administrators and teachers. Staff development for teachers and principals is paramount for growth or improvement.

Pay competitive with business world.

Making teaching financially viable for math and science majors. Salaries and benefits comparable to the private sector.

Small class sizes…up to date materials and facilities, adequate financial support…and support by parents, administrators, community, etc. Better pay…

Let us teach and administer and not keep taking our time with…theory and hoops that discourage people to work in education.

Paying highly qualified teachers.

The AEA coordinators shared concerns in several major areas. Foremost was the need for professional development and training opportunities for teachers. The need to improve salaries for teachers, develop mentors, and provide opportunities for collaboration were also mentioned as concerns. The need for content knowledge and qualified teachers also was a major area of concern for the AEA participants. The following quotes are representative of the feedback from the AEA coordinators.

Content knowledge and how to use effective teaching strategies. Provide opportunities for professional development.

Support for interaction and collaboration with other science teachers, both in district and out of district.

Pay more for math and science teachers.

Opportunities to learn more about effective instructional strategies that support inquiry investigations.

All three participant groups acknowledged that rural and small school districts faced unique challenges and that the issues are often compounded because of size. One AEA coordinator acknowledged the *need for qualified mathematics teachers, especially in rural districts.* Another went on to say that *teacher retirement and attrition will simply compound the shortage of qualified, let alone quality, teachers in math and science. This will even be more of a problem in smaller, rural schools. For those schools with poor facilities with lower than average salaries…the prospect of filling positions in math and science is dismal.* A teacher respondent said that *we are letting excellent, experienced teachers retire in favor of lower cost new teachers. There is no incentive to keep these teachers in smaller schools.* The superintendents' concern was voiced by one who said the problem is *filling vacancies in rural Iowa with qualified staff in the areas of science and math.*

Clearly, respondents from all three groups agreed that salaries (and funding) were a major concern. The superintendents were almost unanimous in including this in their comments; the teachers ranked this first, with several additional issues; the AEA coordinators listed salaries among their top issues. The need for incentives for hiring and retaining mathematics and science teachers was mentioned by all three groups and emerged as a major issue for superintendents. Other issues common to these three groups were the need for resources and lack of time. In addition, government guidelines and too much paperwork were indications of increasing expectations without providing additional time or pay. Specifically, teachers mentioned a need for additional support by administration and parents and a need for mentors and increased collaboration. In addition, teachers frequently cited the need for better teacher preparation and college training, as well as the understanding and usage of multiple strategies and assessments for diverse types of learners.

Teacher Professional Development

The continuing professional development of Iowa's teachers is key to retaining quality teachers. This study examines the adequacy and importance of professional development in selected areas, professional development needs as reported by teachers, what superintendents see as uses of Title II allocations for professional development, the focus of the Regent's higher education program for professional development in mathematics and science education, and the best ways for teachers to learn about mathematics and science reform. All groups responded to questions about teacher professional development. Their responses follow.

Teachers' Opinions on the Adequacy and Importance of Professional Development

Teachers were asked to rate the adequacy and importance of professional development in several areas of teaching skills and knowledge (Table 13). They indicated how adequately they were prepared in each of the general areas and how important professional development opportunities were to them.

Areas rated as adequate or very adequate (mean of 4.00 or higher on the five-point scale) by all teachers included content knowledge in mathematics (4.25), planning and delivering instruction (4.15), selecting and organizing materials (4.06), organizing classroom learning opportunities in large-group, small-group, and individual settings (4.02), content knowledge in science (4.00), and understanding and managing behavior problems in the classroom (4.00).

Content knowledge in mathematics was rated as very adequate by mathematics teachers (4.50) and adequate by other teachers (means of 4.00 and 4.20). Content knowledge in science was rated as adequate by science teachers (4.43), but lower ratings of their content knowledge in science were given by elementary teachers (3.81) and by mathematics teachers (3.72).

Table 13. Adequacy and Importance of Teachers' Professional Development Needs--Teacher Responses

	Adequacy							*Importance*							
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	*Significant differences between adequacy and importance*
A Planning and delivering instruction															
All teachers	0.8%	4.8%	8.5%	50.2%	35.7%	4.15	743	0.4%	1.5%	5.4%	33.2%	59.5%	4.50	740	*
Elementary teachers	1.9%	6.9%	8.4%	51.9%	30.9%	4.03	262	0.8%	0.8%	3.8%	30.2%	64.5%	4.57	262	*
Mathematics teachers	0.4%	3.6%	9.1%	49.2%	37.7%	4.20	252	0.4%	1.6%	6.4%	35.6%	56.0%	4.45	250	*
Science teachers	0.0%	3.9%	7.9%	49.3%	38.9%	4.23	229	0.0%	2.2%	6.1%	34.2%	57.5%	4.47	228	*
B Selecting and organizing materials															
All teachers	0.5%	5.5%	10.6%	54.0%	29.4%	4.06	748	0.4%	1.6%	6.2%	42.3%	49.5%	4.39	740	*
Elementary teachers	0.8%	7.2%	14.8%	49.8%	27.4%	3.96	263	0.8%	0.8%	4.2%	34.7%	59.5%	4.52	262	*
Mathematics teachers	0.8%	2.8%	9.1%	57.9%	29.5%	4.13	254	0.4%	1.6%	8.0%	48.0%	42.0%	4.30	250	*
Science teachers	0.0%	6.5%	7.4%	54.5%	31.6%	4.11	231	0.0%	2.6%	6.6%	44.7%	46.1%	4.34	228	*
C Using instructional strategies such as cooperative learning and peer coaching															
All teachers	0.9%	8.3%	20.4%	49.3%	21.0%	3.81	744	1.1%	4.1%	19.3%	45.3%	30.3%	4.00	737	*
Elementary teachers	1.9%	6.5%	13.4%	54.2%	24.0%	3.92	262	0.8%	1.2%	14.6%	43.8%	39.6%	4.20	260	*
Mathematics teachers	0.4%	11.5%	27.7%	45.5%	15.0%	3.63	253	1.2%	5.2%	22.4%	47.2%	24.0%	3.88	250	*
Science teachers	0.4%	7.0%	20.5%	48.0%	24.0%	3.88	229	1.3%	6.2%	21.1%	44.9%	26.4%	3.89	227	

Adequacy rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

Importance rating scale: 1=very unimportant, 2=unimportant, 3=neutral, 4=important, 5=very important

*Mean importance ratings are significantly higher than mean adequacy ratings.

Table 13. (continued)

	Adequacy							*Importance*							*Significant differences between adequacy and importance*
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	
D Meeting the needs of underrepresented groups in mathematics and science															
All teachers	1.1%	10.3%	28.8%	48.6%	11.3%	3.59	720	1.2%	3.4%	22.6%	44.7%	28.0%	3.95	729	*
Elementary teachers	1.6%	11.6%	28.9%	45.8%	12.0%	3.55	249	1.2%	2.0%	18.5%	41.3%	37.0%	4.11	254	*
Mathematics teachers	1.2%	8.1%	31.5%	50.4%	8.9%	3.58	248	1.6%	4.4%	23.2%	48.4%	22.4%	3.86	250	*
Science teachers	0.4%	11.2%	25.6%	49.8%	13.0%	3.64	223	0.9%	4.0%	26.7%	44.4%	24.0%	3.87	225	*
E Working with students with learning problems															
All teachers	1.9%	17.3%	16.4%	49.5%	14.9%	3.58	739	0.4%	0.8%	8.9%	46.2%	43.6%	4.32	718	*
Elementary teachers	1.6%	15.1%	17.4%	46.9%	19.0%	3.67	258	0.4%	0.4%	3.6%	35.1%	60.5%	4.55	248	*
Mathematics teachers	2.0%	18.0%	16.1%	51.0%	12.9%	3.55	255	0.4%	1.2%	11.9%	51.6%	34.8%	4.19	244	*
Science teachers	2.2%	19.0%	15.5%	50.9%	12.4%	3.52	226	0.4%	0.9%	11.5%	52.7%	34.5%	4.20	226	*
F Making accommodations for students with special needs															
All teachers	1.6%	14.4%	14.2%	50.6%	19.2%	3.71	745	0.4%	1.5%	9.9%	45.1%	43.1%	4.29	745	*
Elementary teachers	1.9%	13.0%	14.6%	47.5%	23.0%	3.77	261	0.4%	1.1%	5.7%	36.4%	56.3%	4.47	261	*
Mathematics teachers	1.2%	15.7%	13.7%	53.7%	15.7%	3.67	255	0.4%	2.0%	11.9%	50.8%	34.9%	4.18	252	*
Science teachers	1.7%	14.4%	14.4%	50.7%	18.8%	3.70	229	0.4%	1.3%	12.5%	48.7%	37.1%	4.21	232	*

Table 13. (continued)

	Adequacy							*Importance*							*Significant differences between adequacy and importance*
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	
G Utilizing multiple assessment measures															
All teachers	1.2%	11.3%	22.3%	47.9%	17.3%	3.69	745	1.5%	3.6%	15.3%	46.7%	32.9%	4.06	745	*
Elementary teachers	1.5%	7.3%	18.7%	52.3%	20.2%	3.82	262	0.8%	1.5%	11.1%	43.5%	43.1%	4.27	262	*
Mathematics teachers	1.6%	17.7%	25.2%	45.3%	10.2%	3.45	254	2.0%	7.1%	18.7%	50.0%	22.2%	3.83	252	*
Science teachers	0.4%	8.7%	23.1%	45.9%	21.8%	3.80	229	1.7%	2.2%	16.5%	46.8%	32.9%	4.07	231	*
H Coordinating curriculum standards and benchmarks with assessment															
All teachers	1.3%	10.0%	20.2%	47.7%	20.7%	3.76	747	3.2%	5.2%	15.3%	41.9%	34.4%	3.99	747	*
Elementary teachers	1.1%	8.0%	18.8%	45.2%	26.8%	3.89	261	0.8%	3.4%	11.8%	36.6%	47.3%	4.26	262	*
Mathematics teachers	1.6%	11.4%	22.4%	49.8%	14.9%	3.65	255	4.3%	4.7%	16.1%	50.0%	24.8%	3.86	254	*
Science teachers	1.3%	10.8%	19.5%	48.1%	20.3%	3.75	231	4.8%	7.8%	18.2%	39.0%	30.3%	3.82	231	
I Understanding and managing behavior problems in the classroom															
All teachers	2.0%	8.2%	8.4%	50.7%	30.7%	4.00	747	0.4%	1.6%	4.8%	33.0%	60.2%	4.51	743	*
Elementary teachers	1.5%	7.6%	6.9%	50.0%	34.0%	4.07	262	0.4%	1.2%	3.1%	24.2%	71.2%	4.65	260	*
Mathematics teachers	1.2%	8.7%	9.4%	52.0%	28.7%	3.98	254	0.8%	1.6%	5.1%	40.6%	52.0%	4.41	254	*
Science teachers	3.5%	8.2%	9.1%	50.2%	29.0%	3.93	231	0.0%	2.2%	6.6%	34.5%	56.8%	4.46	229	*

Table 13. (continued)

	Adequacy							*Importance*							*Significant differences between adequacy and importance*
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	
J Organizing classroom learning opportunities in large-group, small-group, and individual settings															
All teachers	0.4%	5.9%	13.7%	51.1%	28.9%	4.02	747	0.3%	2.1%	9.9%	44.5%	43.2%	4.28	750	*
Elementary teachers	0.0%	5.4%	10.0%	47.9%	36.8%	4.16	261	0.0%	0.4%	4.9%	34.6%	60.1%	4.54	263	*
Mathemtics teachers	1.2%	7.9%	20.9%	51.2%	18.9%	3.79	254	0.4%	3.1%	15.7%	49.8%	31.0%	4.08	255	*
Science teachers	0.0%	4.3%	9.9%	54.7%	31.0%	4.13	232	0.4%	3.0%	9.1%	50.0%	37.5%	4.21	232	
K Using instructional technology in your classroom (e.g., computers, calculators with graphing capabilities)															
All teachers	3.1%	20.1%	19.6%	44.4%	12.9%	3.44	746	0.9%	1.5%	12.1%	51.0%	34.5%	4.17	745	*
Elementary teachers	4.6%	24.1%	21.8%	43.3%	6.1%	3.22	261	1.2%	1.2%	18.1%	48.1%	31.5%	4.08	260	*
Mathematics teachers	2.0%	16.9%	16.5%	47.1%	17.6%	3.62	255	1.2%	1.2%	9.8%	50.2%	37.6%	4.22	255	*
Science teachers	2.6%	19.1%	20.4%	42.6%	15.2%	3.49	230	0.4%	2.2%	7.8%	55.2%	34.3%	4.21	230	*
L Incorporating environmental education into the curriculum															
All teachers	3.1%	19.3%	34.3%	35.4%	7.9%	3.26	709	2.0%	7.0%	30.5%	40.3%	20.2%	3.70	712	*
Elementary teachers	3.2%	18.2%	30.8%	39.9%	7.9%	3.31	253	0.0%	4.3%	20.5%	49.6%	25.6%	3.96	254	*
Mathematics teachers	4.4%	28.6%	46.3%	18.9%	1.8%	2.85	227	5.7%	10.1%	47.4%	27.2%	9.6%	3.25	228	*
Science teachers	1.7%	11.4%	26.2%	46.7%	14.0%	3.60	229	0.4%	7.0%	24.8%	43.0%	24.8%	3.85	230	*

Table 13. (continued)

	Adequacy							*Importance*							*Significant differences between adequacy and importance*
	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*N of valid responses*	*Very unimportant*	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*N of valid responses*	
M Content knowledge in mathematics															
All teachers	0.7%	2.4%	8.3%	48.9%	39.8%	4.25	714	0.7%	0.7%	5.4%	36.9%	56.3%	4.47	718	*
Elementary teachers	0.8%	3.1%	7.7%	52.7%	35.8%	4.20	260	0.4%	0.4%	3.1%	30.6%	65.5%	4.60	258	*
Mathematics teachers	0.4%	1.2%	3.6%	37.8%	57.0%	4.50	251	0.8%	1.2%	4.0%	30.6%	63.5%	4.55	252	
Science teachers	1.0%	3.0%	14.8%	57.6%	23.6%	4.00	203	1.0%	0.5%	10.1%	52.4%	36.1%	4.22	208	*
N Content knowledge in science															
All teachers	0.6%	6.9%	15.2%	46.1%	31.3%	4.00	640	1.1%	1.8%	8.6%	35.1%	53.4%	4.38	652	*
Elementary teachers	0.4%	9.3%	18.3%	53.3%	18.7%	3.81	257	0.0%	1.2%	7.5%	36.5%	54.9%	4.45	255	*
Mathematics teachers	1.3%	8.4%	26.5%	45.2%	18.7%	3.72	155	2.4%	4.1%	17.6%	40.0%	35.9%	4.03	170	*
Science teachers	0.4%	3.1%	3.9%	38.6%	53.9%	4.43	228	1.3%	0.9%	3.1%	30.0%	64.8%	4.56	227	*

The lowest ratings for adequacy of professional development were given for incorporating environmental education into the curriculum (all teachers—3.26 and mathematics teachers—2.85) and using instructional technology in the classroom (all teachers—3.44 and elementary teachers—3.22).

Several areas were rated as important or very important (mean of 4.00 or higher on the five-point scale) by all teachers, including understanding and managing behavior problems in the classroom (4.51), planning and delivering instruction (4.50), selecting and organizing materials (4.39), working with students with learning problems (4.32), making accommodations for students with special needs (4.29), organizing classroom learning opportunities in large-group, small-group, and individual settings (4.28), using instructional technology in the classroom (4.17), utilizing multiple assessment measures (4.06), and using instructional strategies such as cooperative learning and peer coaching (4.00). Content knowledge in mathematics was rated as important by mathematics teachers (4.55) and elementary teachers (4.60). Likewise, content knowledge in science was rated as very important by science teachers (4.56) and elementary teachers (4.45).

A comparison of the adequacy and importance ratings shows few differences among teacher groups. The means for all teachers combined, elementary teachers, mathematics teachers, and science teachers were plotted to understand, in particular, which factors had lower adequacy ratings along with corresponding higher importance ratings. Figures 9 through 12 show the details of which factors fall into each of four quadrants—low adequacy/low importance; high adequacy/low importance; low adequacy/high importance; and high adequacy/high importance. The quadrant containing factors with low adequacy/high importance indicates areas needing attention. The analysis showed that only in one area, incorporating environmental education into the curriculum (L), was a need revealed for mathematics teachers.

Figure 9. Comparison of Mean Ratings of Adequacy and Importance of Factors Related to Teacher Professional Development--Areas of Need Indicated by All Teachers

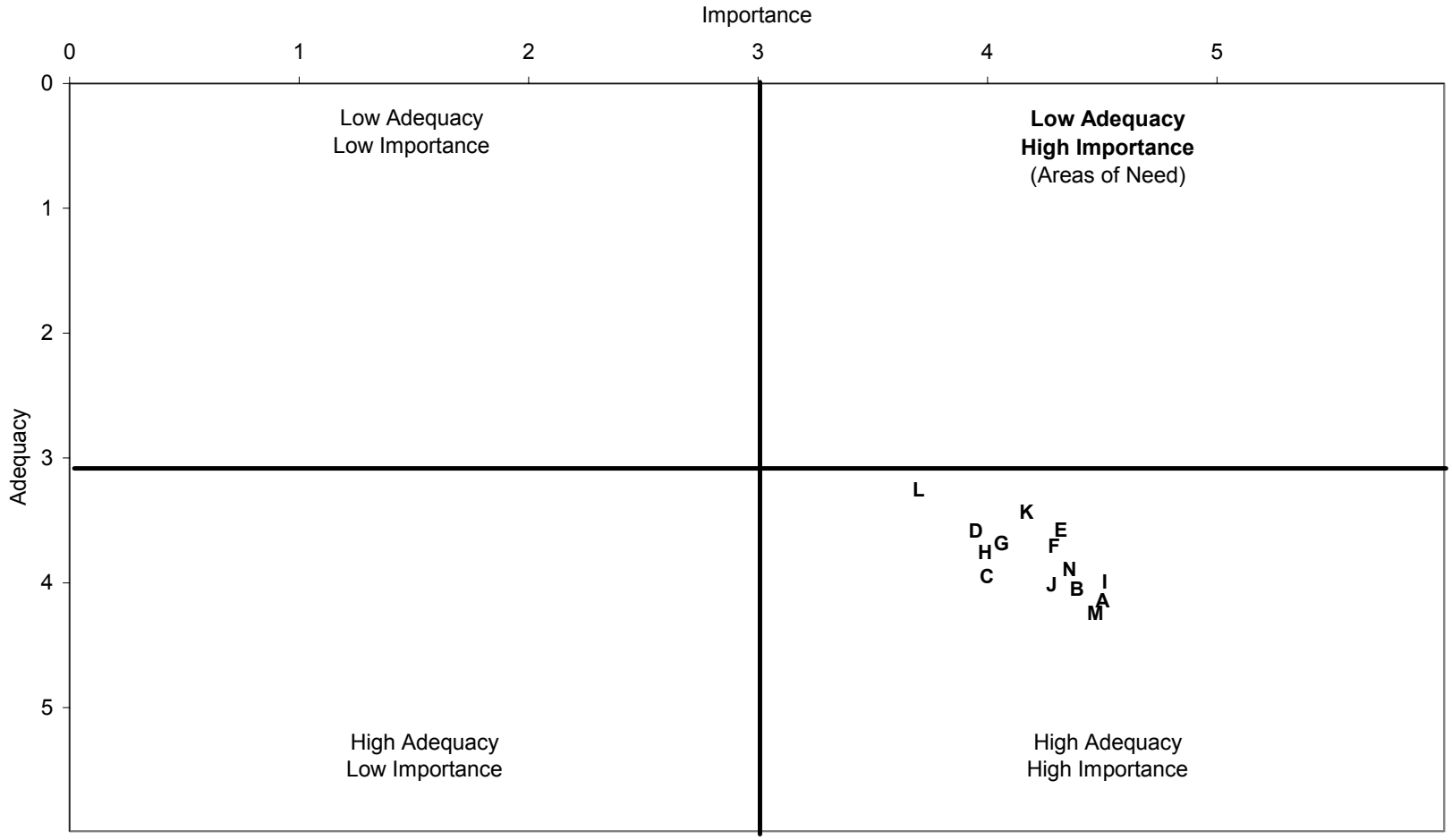


Figure 10. Comparison of Mean Ratings of Adequacy and Importance of Factors Related to Teacher Professional Development--Areas of Need Indicated by Elementary Teachers

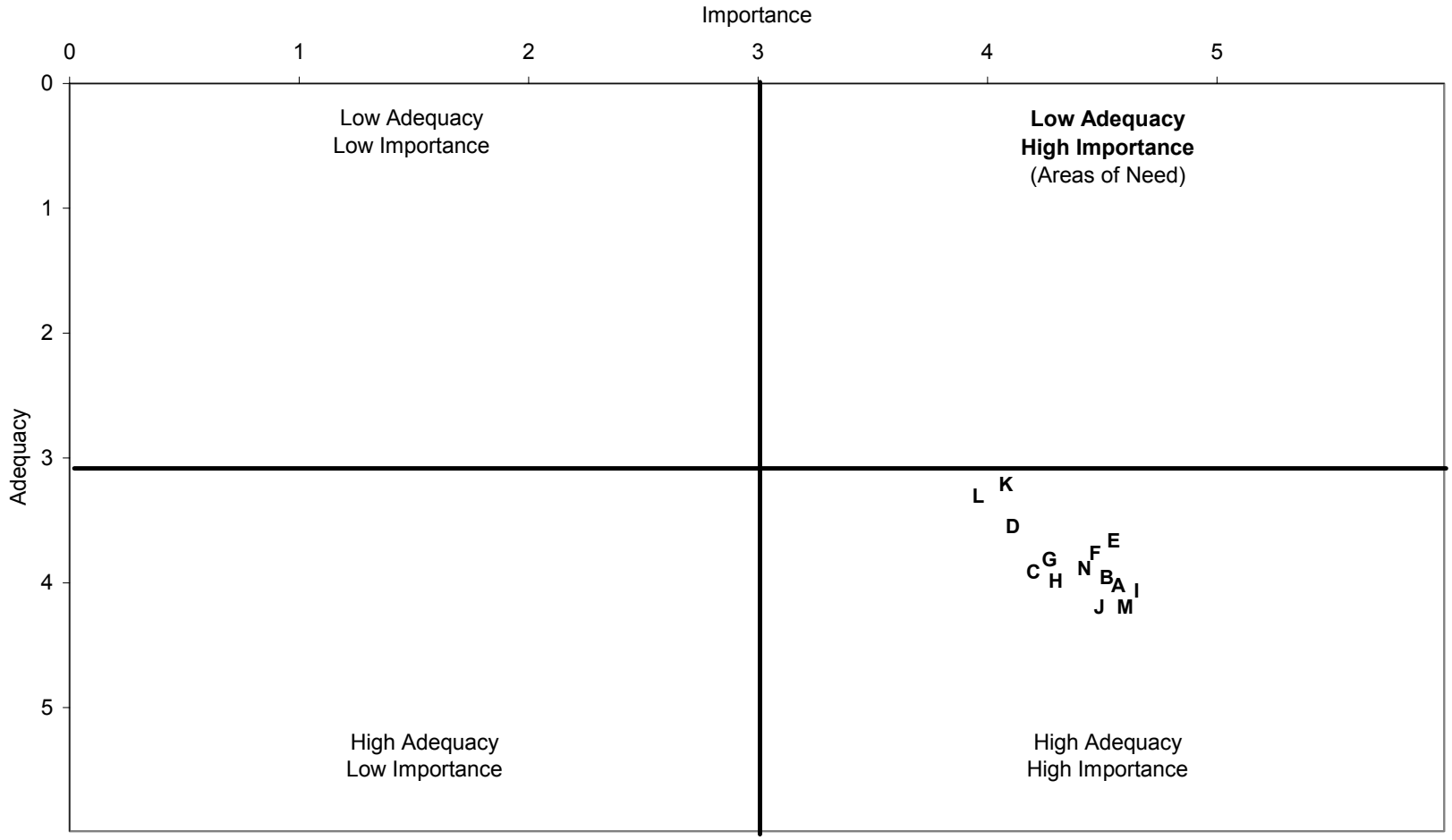


Figure 11. Comparison of Mean Ratings of Adequacy and Importance of Factors Related to Teacher Professional Development--Areas of Need Indicated by Mathematics Teachers

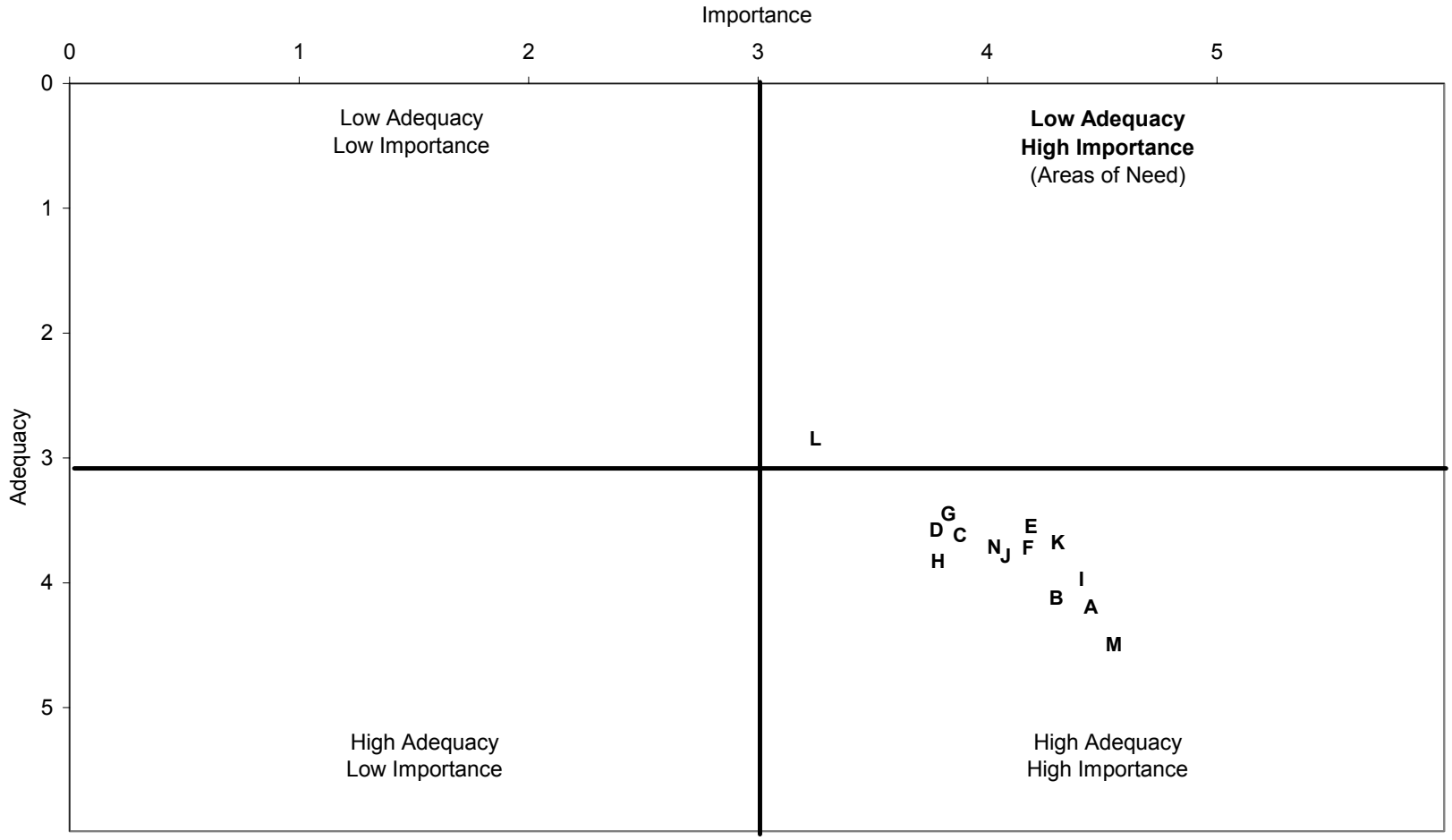
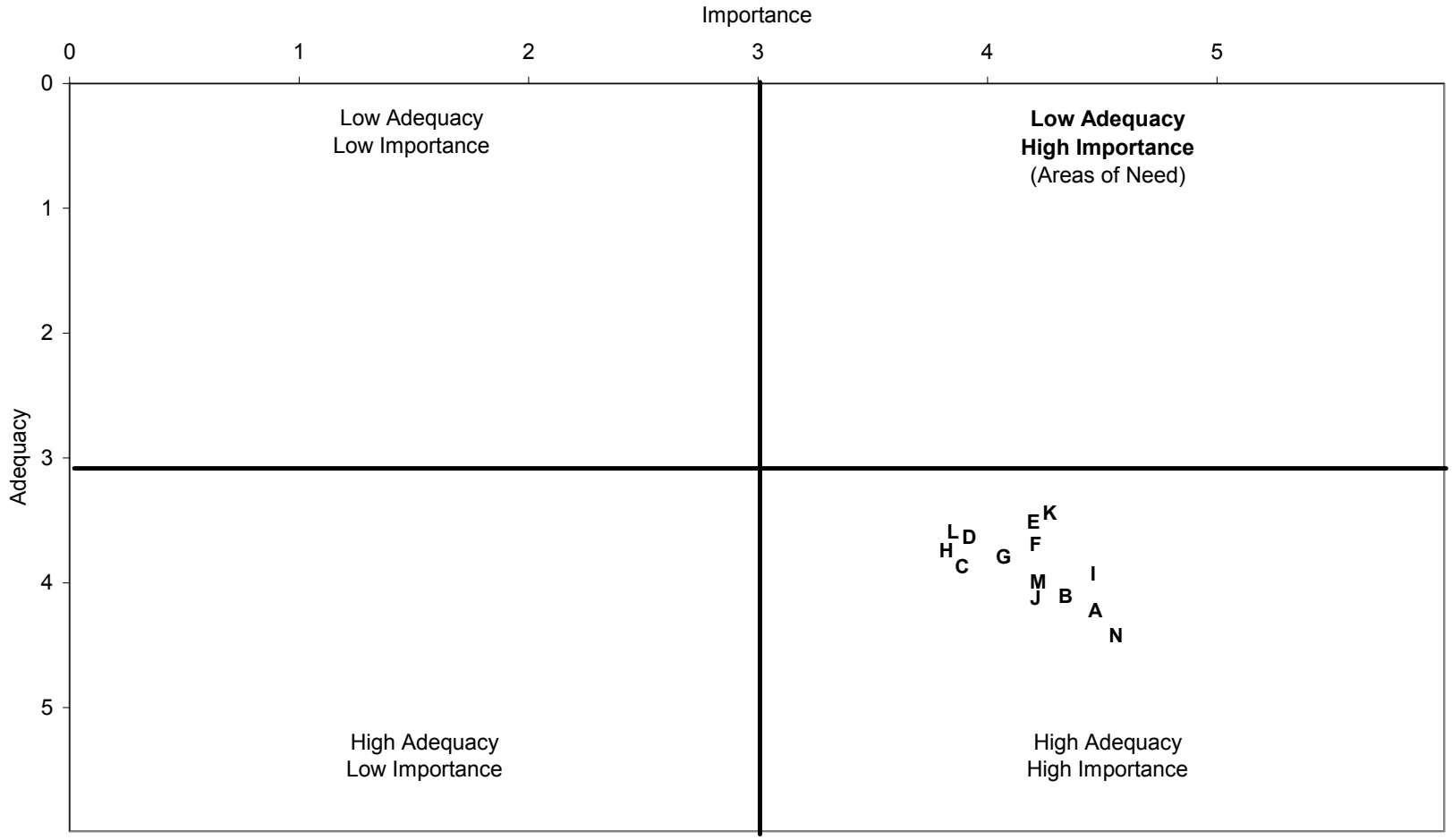


Figure 12. Comparison of Mean Ratings of Adequacy and Importance of Factors Related to Teacher Professional Development--Areas of Need Indicated by Science Teachers



Teachers' Needs for Professional Development/Inservice Training

In addition to understanding the adequacy of their training and the importance of professional development in certain areas, additional questions were asked about teachers' need for professional development and inservice training. As shown in Table 14, 70% of elementary teachers agreed that they needed more opportunities for professional development or inservices in content knowledge in mathematics; 56% of mathematics teachers agreed. Both elementary teachers (77%) and mathematics teachers (76%) agreed that they needed inservice in incorporating NCTM standards.

Similar results are evident for elementary teachers and science teachers regarding science content and standards (Table 15). Over 80% of the elementary teachers needed more opportunities for professional development or inservice training in content knowledge in science and in incorporating recent science reforms. Sixty-five percent of the science teachers needed inservice in content, while 81% reported needing professional development opportunities in incorporating science standards.

A fourth question asked teachers to indicate their need for professional development or inservice training in specific areas. They responded in terms of no need to a very high need (Table 16). Half or more of all teachers reported some need to high need in the following areas:

- using instructional technology in teaching mathematics and science (72%)
- working with students with learning problems (70%)
- using multiple assessment measures (63%)
- using strategies to meet the needs of underrepresented groups in mathematics and science (57%)
- using environmental education strategies to enhance curriculum (56%)

Table 14. Mathematics Teachers' Opinions on Professional Development/Inservice Training

	Strongly disagree	*Disagree*	*Somewhat disagree*	*Somewhat agree*	*Agree*	*Strongly agree*	*Mean*	*S.D.*	*N*
I need more opportunities for professional development/inservice training in content knowledge in mathematics.									
Elementary teachers	2.8%	12.7%	14.3%	36.7%	24.7%	8.8%	3.94	1.23	251
Mathematics teachers	7.9%	23.8%	12.7%	30.2%	17.9%	7.5%	3.49	1.42	252
I need more opportunities for professional development/inservice training in incorporating NCTM standards.									
Elementary teachers	1.2%	9.2%	12.4%	40.6%	26.1%	10.4%	4.12	1.13	249
Mathematics teachers	3.6%	8.3%	12.3%	40.5%	27.0%	8.3%	4.04	1.18	252

Rating scale: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree

Table 15. Science Teachers' Opinions on Professional Development/Inservice Training

	Strongly disagree	*Disagree*	*Somewhat disagree*	*Somewhat agree*	*Agree*	*Strongly agree*	*Mean*	*S.D.*	*N*
I need more opportunities for professional development/inservice training in content knowledge in science.									
Elementary teachers	1.3%	5.8%	12.0%	39.1%	27.1%	14.7%	4.29	1.12	225
Science teachers	7.5%	16.3%	11.0%	29.1%	28.2%	7.9%	3.78	1.41	227
I need more opportunities for professional development/inservice training in incorporating recent recommendations for science reform.									
Elementary teachers	1.8%	3.6%	12.6%	36.9%	31.1%	14.0%	4.34	1.09	222
Science teachers	4.4%	5.3%	9.7%	37.4%	33.9%	9.3%	4.19	1.18	227

Table 16. Teachers' Needs for Professional Development/Inservice Training

	No need	*Low need*	*Some need*	*High need*	*Very high need*	*Mean*	*S.D.*	*N*
Using instructional strategies such as cooperative learning and peer coaching								
All teachers	11.3%	37.3%	42.3%	7.6%	1.5%	2.51	0.85	751
Elementary teachers	11.4%	37.1%	42.8%	6.8%	1.9%	2.51	0.85	264
Mathematics teachers	10.9%	36.7%	43.0%	8.6%	0.8%	2.52	0.83	256
Science teachers	11.7%	38.1%	41.1%	7.4%	1.7%	2.49	0.86	231
Using strategies to meet the needs of underrepresented groups in mathematics and science								
All teachers	9.0%	31.4%	44.9%	12.2%	2.5%	2.68	0.89	748
Elementary teachers	6.5%	27.4%	48.7%	13.7%	3.8%	2.81	0.89	263
Mathematics teachers	11.4%	32.9%	42.7%	11.8%	1.2%	2.58	0.88	255
Science teachers	9.1%	34.3%	43.0%	10.9%	2.6%	2.63	0.89	230
Working with students with learning problems								
All teachers	4.8%	21.1%	46.4%	23.6%	4.1%	3.01	0.90	750
Elementary teachers	5.7%	19.3%	46.2%	23.5%	5.3%	3.03	0.93	264
Mathematics teachers	3.1%	21.5%	49.6%	22.7%	3.1%	3.01	0.83	256
Science teachers	5.7%	22.6%	43.0%	24.8%	3.9%	2.99	0.93	230
Using multiple assessment measures								
All teachers	7.4%	25.3%	43.0%	20.2%	4.1%	2.88	0.95	752
Elementary teachers	9.5%	23.5%	40.2%	22.0%	4.9%	2.89	1.01	264
Mathematics teachers	5.5%	23.0%	44.9%	23.8%	2.7%	2.95	0.89	256
Science teachers	7.3%	29.7%	44.0%	14.2%	4.7%	2.79	0.94	232

Rating scale: 1=no need, 2=low need, 3=some need, 4=high need, 5=very high need

Table 16. (continued)

	No need	*Low need*	*Some need*	*High need*	*Very high need*	*Mean*	*S.D.*	*N*
Aligning curriculum standards and benchmarks with assessment								
All teachers	11.5%	31.7%	32.8%	18.5%	5.5%	2.75	1.06	750
Elementary teachers	13.3%	30.4%	29.3%	19.4%	7.6%	2.78	1.14	263
Mathematics teachers	9.0%	32.8%	35.5%	17.2%	5.5%	2.77	1.02	256
Science teachers	12.1%	32.0%	33.8%	19.0%	3.0%	2.69	1.01	231
Understanding and managing behavior problems in the classroom								
All teachers	14.0%	34.0%	31.0%	13.5%	7.5%	2.66	1.11	748
Elementary teachers	13.7%	30.5%	33.6%	12.2%	9.9%	2.74	1.15	262
Mathematics teachers	12.9%	36.3%	30.1%	14.8%	5.9%	2.64	1.07	256
Science teachers	15.7%	35.2%	29.1%	13.5%	6.5%	2.60	1.10	230
Organizing classroom learning opportunities in large-group, small-group, and individual settings								
All teachers	14.2%	37.0%	34.4%	10.5%	3.9%	2.53	0.99	751
Elementary teachers	16.7%	34.8%	31.4%	11.7%	5.3%	2.54	1.07	264
Mathematics teachers	10.5%	38.7%	38.3%	10.2%	2.3%	2.55	0.90	256
Science teachers	15.6%	37.7%	33.3%	9.5%	3.9%	2.48	1.00	231
Using instructional technology in teaching mathematics and science								
All teachers	4.3%	14.0%	42.0%	29.6%	10.1%	3.27	0.97	750
Elementary teachers	2.7%	11.7%	40.9%	32.2%	12.5%	3.40	0.94	264
Mathematics teachers	5.9%	15.4%	42.1%	28.3%	8.3%	3.18	0.99	254
Science teachers	4.3%	15.1%	43.1%	28.0%	9.5%	3.23	0.97	232

Table 16. (continued)

	No need	*Low need*	*Some need*	*High need*	*Very high need*	*Mean*	*S.D.*	*N*
Using the Iowa Communications Network (ICN), Iowa's fiber-optic telecommunications network								
All teachers	15.7%	28.4%	34.4%	16.7%	4.8%	2.66	1.08	750
Elementary teachers	14.1%	25.6%	33.6%	19.1%	7.6%	2.81	1.13	262
Mathematics teachers	15.6%	32.0%	33.2%	17.2%	2.0%	2.58	1.01	256
Science teachers	17.7%	27.6%	36.6%	13.4%	4.7%	2.60	1.07	232
Using environmental education strategies to enhance curriculum								
All teachers	11.3%	29.8%	37.4%	18.5%	3.1%	2.72	0.99	746
Elementary teachers	6.5%	25.1%	42.6%	21.7%	4.2%	2.92	0.94	263
Mathematics teachers	16.0%	33.2%	31.6%	16.0%	3.2%	2.57	1.04	250
Science teachers	11.6%	31.3%	37.8%	17.6%	1.7%	2.67	0.96	233

- aligning curriculum standards and benchmarks with assessment (51%)
- using the Iowa Communications Network (ICN) (51%)
- using instructional strategies such as cooperative learning and peer coaching (50%).

Within these areas, an additional 13% of elementary teachers, 8% of mathematics teachers, and 10% of science teachers indicated a very high need for professional development in using instructional technology in teaching mathematics and science. Although not considered overall as an area with high need for professional development, 10% of elementary teachers reported a very high need for training in understanding and managing behavior problems in the classroom.

Title II Allocations—What Superintendents Plan for Teacher Professional Development

Superintendents were asked to indicate what percentage of their new Title II allocation for 2002-2003 they would set aside for mathematics and science teachers' professional development. Figure 13 shows that approximately one-third (33%) of the superintendents plan to use less than 10% of the funds and one-third (35%) would use 10-25%. Eighteen percent plan to set aside 25-40%, while 14% plan to use more than 40% of their allocation on professional development activities for their mathematics and science teachers.

For those who will allocate Title II funds for professional development, superintendents have planned a variety of activities (Figure 14). A majority of superintendents (71%) have planned to use the funds to align standards and benchmarks with assessments, 60% will fund workshops, and 56% will send teachers to mathematics and science conferences. Working with AEA mathematics and science coordinators to plan activities was mentioned by 45%

Figure 13. Percentage of 2002-2003 Title II Allocation to be Set Aside for Teachers' Professional Development

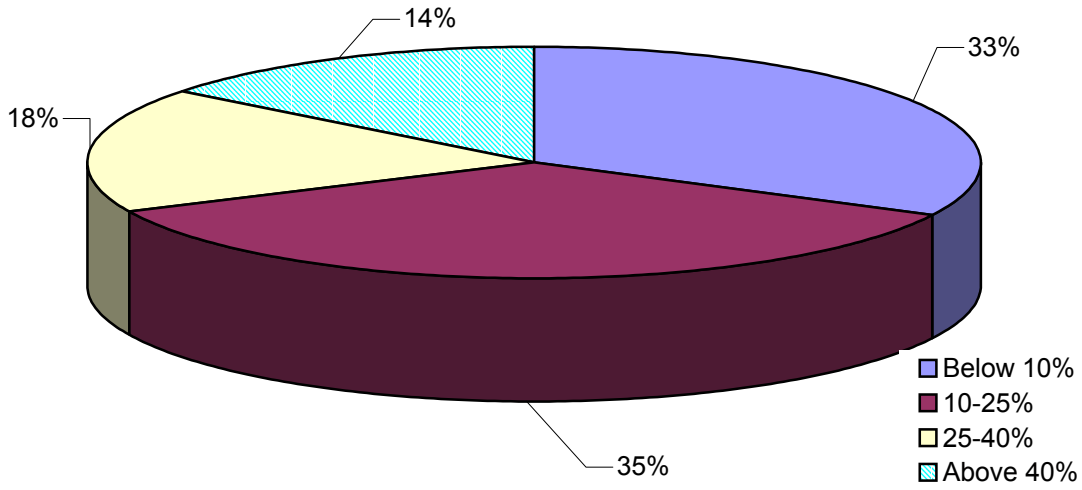
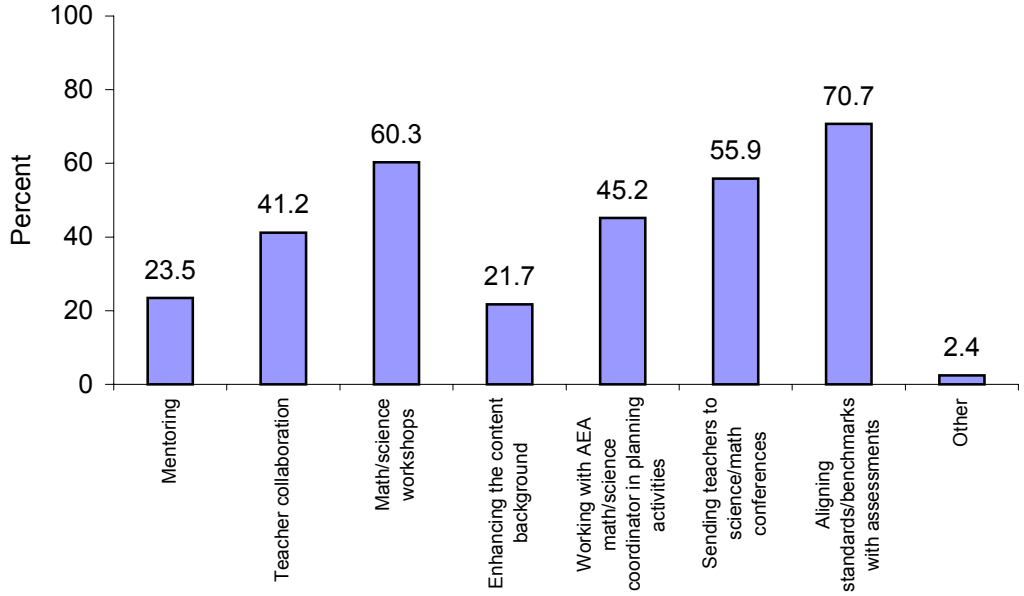


Figure 14. Percentage of Superintendents Planning Professional Development Activities for Mathematics and Science from Title II Funds



of the superintendents, and paying for teacher collaborations was noted by 41%. Also mentioned was funding mentoring programs (24%) and enhancing content background (22%).

AEA Coordinators and Higher Education Faculty Opinions on Teacher Professional Development

AEA mathematics and science coordinators and faculty at higher education institutions provide professional development activities for teachers. In the study, they provided information on the focus of the Regent's higher education program for professional development in the next five years, as well as suggestions for the major emphasis for professional development in mathematics and science education.

In the past, the Regent's higher education program for professional development has focused on establishing model classrooms and developing teams of teacher leaders in mathematics and science. AEA mathematics and science coordinators and higher education faculty were asked to rank their top three choices from a list of possible topics in order to recommend a focus they would like higher education institutions to have in mathematics and science professional development in the next five years (Table 17). Total points were calculated to determine the final ranking for each group of respondents, with a ranking of 1 receiving three points, a ranking of 2 receiving two points, and a ranking of 3 receiving 1 point.

The top three ranked professional development topics were consistent for AEA coordinators, mathematics faculty, and science faculty. Enhancing content of mathematics and science teachers was ranked first by AEA coordinators (42 points) and mathematics faculty (34 points), and second by science faculty (17 points). Implementing the national science and mathematics standards into district curriculum was ranked second by all three groups. Incorporating

Table 17. Rankings for Focus of Regent's Higher Education Program for Professional Development--AEA Coordinators and Higher Education Faculty

	Number of 1 ranking	*Number of 2 ranking*	*Number of 3 ranking*	*Not ranked*	*Total points*	*Final rank 1-3*
Enhancing content of mathematics/science teachers						
AEA coordinators	11	3	3	9	42	1
Higher education mathematics faculty	8	3	4	5	34	1
Higher education science faculty	0	7	3	12	17	2
Developing teacher leader teams for mathematics/science in school districts						
AEA coordinators	3	5	3	15	22	
Higher education mathematics faculty	3	2	1	14	14	
Higher education science faculty	1	3	4	14	13	
Aligning standards and benchmarks with assessments						
AEA coordinators	2	6	4	14	20	
Higher education mathematics faculty	1	2	3	14	10	
Higher education science faculty	2	2	6	12	16	
Working with students and benchmarks with assessment						
AEA coordinators	0	2	3	21	7	
Higher education mathematics faculty	0	0	2	18	2	
Higher education science faculty	1	0	2	19	5	
Implementing the national science and mathematics standards into your district's curriculum						
AEA coordinators	6	4	4	12	30	2
Higher education mathematics faculty	4	4	1	11	21	2
Higher education science faculty	2	5	1	14	17	2
Incorporating inquiry-based learning in mathematics and science						
AEA coordinators	3	5	7	11	26	3
Higher education mathematics faculty	1	5	5	11	18	3
Higher education science faculty	10	3	3	6	39	1

Total points computed as 1 ranking=3 points, 2 ranking=2 points, and 3 ranking=1 point

Table 17. (continued)

	Number of 1 ranking	*Number of 2 ranking*	*Number of 3 ranking*	*Not ranked*	*Total points*	*Final rank 1-3*
Improving student achievement using the environment as an integrating context						
AEA coordinators	0	0	0	26	0	
Higher education mathematics faculty	0	0	0	20	0	
Higher education science faculty	4	0	0	18	12	
Other						
AEA coordinators	0	0	0	26	0	
Higher education mathematics faculty	2	1	0	17	7	
Higher education science faculty	1	0	1	20	4	

inquiry-based learning in mathematics and science was ranked third by AEA coordinators (26 points) and mathematics faculty (21 points), but first by science faculty (39 points). Other topics with higher ranked items included developing teacher leader teams for mathematics and science in school districts and aligning standards and benchmarks with assessments.

In a related question, AEA mathematics and science coordinators were asked to comment in an open-ended format on what the major focus for professional development in mathematics and science should be in the next three years. For mathematics, inservice opportunities in learning styles and how they impact mathematics instruction, differentiated instructional strategies, how to use assessment to inform instruction, and integrating technology were suggested. AEA coordinators also recommended keeping a focus on student learning by improving content knowledge and understanding. One respondent wrote that this focus should *help teachers better meet Iowa teaching standards by competence in content knowledge, planning and preparing for instruction; using assessments and assessment data to guide instruction; and using a variety of methods to monitor student learning*. They also mentioned that *teachers need a clearer understanding of the match between standards and benchmarks and specific instructional strategies and appropriate assessment*.

For science, two primary areas of focus were mentioned. First, AEA coordinators felt that a major focus for professional development in science should be inquiry-based instruction. They suggested programs to help teachers implement inquiry-based instruction, exploration, and constructivist models, as well as workshops with modeling and coaching assistance to learn by "doing." They also recommended a focus on aligning instruction with standards, benchmarks, and assessments.

Best Ways for Teachers to Learn about Mathematics and Science Reform

Teachers, superintendents, AEA coordinators, and higher education faculty suggested the best ways for teachers to learn about mathematics and science reform. There was agreement from all four respondent groups, as all groups cited professional development/inservices/workshops as the best way to learn about math and science reform. Other themes that were mentioned across respondent groups included peer assistance, publications, conference attendance, and graduate or formal education classes. While several of the themes identified as best ways to learn about math and science reform were common across groups surveyed, each respondent group had their own specific concerns and suggestions. The following summarizes responses from each of the respondent groups:

Elementary Teachers

- Professional development/inservice
- Peer mentoring
- Publications
- Attend conferences
- Graduate classes (formal education)

Secondary Mathematics Teachers

- Professional development/inservice
- Attend conferences
- Publications
- Graduate classes (formal education)
- Peer mentoring

Secondary Science Teachers

- Professional development/inservices
- Publications
- Graduate classes (formal education)
- Attend conferences
- Peer mentoring

Superintendents

- Professional development/inservice

- Peer mentoring
- Publications
- Attend conferences
- Technology
- Join professional organization
- Graduate classes (formal education)

AEA Coordinators

- Professional development/inservice
- Peer mentoring
- Publications
- Attend conferences

Higher Education Faculty

- Professional development/inservice
- Join professional organization
- Publications
- Graduate classes (formal education)
- Technology

Teachers. Teachers (elementary, secondary mathematics, and secondary science) indicated that the one of the best ways to learn math and science reform was through inservice. Teachers stated often that inservices should include a "hands on" approach. Examples of specific comments from teachers regarding hands-on training were:

> *The best way for me to learn is to have hands-on activities to learn new concepts.*
>
> *Hands-on, just like my students. Teachers sharing with teachers.*
>
> *Don't talk the talk (speaker); show teachers doing their job. . .visit classrooms.*

Both secondary mathematics and science teachers expressed that inservices should be content specific to their areas. They mentioned that many inservices are too broad and should relate directly to the courses that are taught by secondary teachers. Other common suggestions for conducting inservices

included using AEA staff, higher education professionals, and technology to disseminate information. Teachers requested that there should be multiple opportunities to attend inservices and that inservices should be offered in many locations (i.e., not just in Des Moines). However, teachers differed in opinions on when to offer inservices. Some requested weekend and evening inservices, while others requested inservices during the work day or during class time.

Another common response among elementary teachers as the best way to learn about mathematics and science reform was to learn from their peers. Specifically, teachers needing to learn about mathematics and science reform could visit classrooms and observe teachers who have already excelled in implementing the reforms. Providing support groups of peers and sample lesson plans successfully used by peers were also mentioned as ways to learn about reform. Secondary mathematics and science teachers mentioned using peers as a way to learn about reform, but with a lower frequency than did elementary teachers.

All three groups of teachers suggested learning about mathematics and science reform through the circulation of publications (e.g., newsletters, journals). One respondent suggested that publications should be made available to all teachers, not just one copy per building.

Providing funds and time to attend conferences was another common theme identified by teachers. Specific conferences identified for attendance by secondary mathematics teachers were those offered and/or sponsored by NCTM and/or ICTM.

Teachers recognized that increased funding and more time are needed to support these ways for learning about mathematics and science reform. Funding was also mentioned when teachers suggested taking college/graduate classes as an effective way to learn about mathematics and science reform. Specific comments encouraged that monetary incentives be provided to teachers for taking additional college coursework.

Superintendents. Like the teachers, the most frequent response among superintendents for the best way to learn about mathematics and science reform was through the use of inservices. While superintendents suggested a variety of resources for leading inservices, they most frequently mentioned using AEA staff to conduct the inservices. These comments are representative:

> *For us, the AEA is the best source. With so many initiatives going on at the same time, one good source is the best.*
>
> *AEA inservices. . .where teachers can hear what the expectations for them are.*
>
> *From AEA inservices and workshops. The state should be helping more in this area.*

However, superintendents were not unanimous in their support of using AEAs as the best way to learn about math and science reform. Some superintendents stated:

> *Some* [reform] *could be done in college or paid summer institutes. . .in many cases, the AEA and the DE are little help. It didn't used to be that way. . .AEAs and the DE need to work on getting our respect back!*
>
> *AEAs need to be sure the focus is not just on reading, but also expertise is provided for math and science. So much is now focused on reading, we're losing the emphasis at elementary on math and science.*

Superintendents also suggested that teachers learn from their peers who serve as mentors. They suggested that teachers visit and observe other classrooms where mathematics and science reform has already been implemented successfully. Superintendents also mentioned that samples of lesson plans and study groups led by teachers who have implemented reform successfully could be used as tools for learning about mathematics and science reform.

Like teachers, superintendents mentioned the use of publications, with journals cited most often. Conference attendance and summer institutes were

also mentioned by superintendents as a way to learn about reform. However, they realized the need for increased funding to allow more teachers to attend these events.

The use of technology (i.e., ICN, internet, and e-mail) was another common response from superintendents as a way to learn about mathematics and science reform. Superintendents who listed this response identified lack of time as an obstacle in learning about reform and suggested that technology might be one way of disseminating information that would allow teachers more flexibility to fit it in their schedules. Superintendents also noted joining a professional organization or attending college classes (formal education) as ways to learn about mathematics and science reform.

AEA Coordinators. AEA coordinators identified four ways for teachers to learn about mathematics and science reform—professional development, peers as mentors, reading publications, and attending conferences. They thought that professional development using a variety of methods, including inservices, workshops, study groups, ICN, internet, local learning teams, and collaboration would be effective. They stated that any professional development offered for teachers should be long term, with a significant amount of follow-up and contact with their AEAs. A comment made by one of the AEA respondents summarized this general theme:

> *I think teachers learn most effectively when the professional development activity occurs over an extended period of time (i.e., several months), involves teachers trying what they're learning with their students, involves looking at real student work (preferably work from their own students), and can be clearly shown to make a difference – students achieve better test scores, become more knowledgeable, better problem solvers, etc. . . The professional development effort should incorporate best practice theory, demonstration, feedback, practice, coaching. . .*

Further, AEA coordinators suggested that teachers visit and observe the classrooms of their peers who have successfully implemented mathematics and science reform, and/or form study groups to discuss and learn about mathematics and science reform. Their other suggestions included learning about mathematics and science reform through reading and studying publications (e.g., journals, newsletters, professional literature) and attending conferences. Like the other groups, AEA coordinators also recognized the need for funding to help teachers learn about mathematics and science reform.

Higher Education Faculty. Five prevalent themes were identified by higher education faculty in mathematics and science, including professional development, membership in a professional organization, studying publications, higher education coursework, and technology. Like the other three groups, higher education faculty most frequently mentioned professional development/inservices as the best way to learn about mathematics and science reform. They agreed with the AEA coordinators that any professional development be long term. They also commented that inservices and workshops should come from the AEAs and/or the higher education institutions and be well funded. One higher education respondent stated:

> *Teachers need long term and well funded support to change mathematics and science education. . . Teachers need to be given autonomy to work for important meaningful educational goals and they need partners from DOE, higher education, and AEAs who are willing to truly work collaboratively to empower teachers to be the solution.*

Higher education faculty also mentioned that teachers join a professional organization that offered conferences where they could learn about mathematics and science reform. They also suggested reviewing journals and other academic publications and participating in formal coursework, but called for including incentives for taking classes and extending a teacher's formal education. Using

technology as a tool for learning about reform was identified as well. Examples of technology that were commonly cited included using the internet, the ICN, and email to disseminate information regarding mathematics and science reform.

Implementing Reforms in K-12 Classrooms in Iowa

A significant component of this 2002 needs assessment for mathematics and science is a review of the implementation of reforms in K-12 classrooms in Iowa from the point of view of teachers, superintendents, and AEA mathematics and science coordinators. To provide this information, teachers were asked to indicate how effective they have been in incorporating mathematics and science standards in their classrooms, how they talk about and work with their colleagues regarding standards, and how they incorporate the standards into their teaching.

Superintendents and AEA coordinators provided their opinions on how local standards and benchmarks have affected student achievement and instruction. Teachers and superintendents reported about revisions to their curriculums and the effect of the standards on the curriculum. Finally, all of the respondent groups—teachers, superintendents, AEA coordinators, and higher education faculty—wrote about the best ways for the Department of Education, the AEAs, local school districts, and higher education institutions to assist teachers in incorporating mathematics and science reform into their classrooms. The following sections detail the results for these topics.

Teachers' Effectiveness in Incorporating Standards

Teachers were asked to indicate their effectiveness in incorporating mathematics and/or science standards in their classrooms. The results are shown in Table 18. Teachers reported that they have been somewhat effective to effective in incorporating the standards overall, as well as those standards related to instructional methods, curriculum changes, and assessment practices.

Table 18. Teachers' Effectiveness of Incorporating Reform in the Classroom

	Very ineffective	*Ineffective*	*Somewhat ineffective*	*Somewhat effective*	*Effective*	*Very effective*	*Number not incorporating reforms*	*Mean*	*S.D.*	*N*
Mathematics and / or science standards overall										
All teacher respondents	0.5%	1.9%	4.5%	31.5%	51.0%	10.6%	10	4.62	0.85	739
Elementary teachers	0.4%	1.2%	5.4%	32.4%	51.7%	8.9%	4	4.61	0.80	259
Mathematics teachers	0.4%	1.6%	3.2%	34.4%	50.4%	10.0%	4	4.63	0.80	250
Science teachers	0.9%	3.0%	4.8%	27.4%	50.9%	13.0%	2	4.63	0.94	230
Mathematics and / or science standards related to instructional methods										
All teacher respondents	0.4%	1.8%	6.2%	37.0%	47.3%	7.4%	14	4.51	0.82	730
Elementary teachers	0.0%	2.3%	4.7%	34.2%	51.0%	7.8%	5	4.57	0.80	257
Mathematics teachers	0.4%	1.2%	5.7%	41.1%	47.6%	4.1%	6	4.46	0.75	246
Science teachers	0.9%	1.8%	8.4%	35.7%	42.7%	10.6%	3	4.49	0.92	227
Mathematics and / or science standards related to curriculum changes										
All teacher respondents	0.6%	1.5%	9.8%	37.3%	42.9%	8.0%	17	4.44	0.87	727
Elementary teachers	0.0%	1.2%	9.0%	38.4%	43.9%	7.5%	7	4.47	0.81	255
Mathematics teachers	0.8%	1.6%	9.7%	38.5%	42.5%	6.9%	6	4.41	0.88	247
Science teachers	0.9%	1.8%	10.7%	34.7%	42.2%	9.8%	4	4.45	0.94	225

Rating scale: 1=very ineffective, 2=ineffective, 3=somewhat ineffective, 4=somewhat effective, 5=effective, 6=very effective

Table 18. (continued)

	Very ineffective	*Ineffective*	*Somewhat ineffective*	*Somewhat effective*	*Effective*	*Very effective*	*Number not incorporating reforms*	*Mean*	*S.D.*	*N*
Mathematics and / or science standards related to assessment practices										
All teacher respondents	0.8%	3.3%	13.9%	43.1%	32.8%	6.0%	17	4.22	0.93	728
Elementary teachers	0.4%	2.0%	12.9%	41.4%	38.3%	5.1%	6	4.30	0.86	256
Mathematics teachers	1.2%	4.0%	13.8%	48.2%	29.6%	3.2%	6	4.11	0.91	247
Science teachers	0.9%	4.0%	15.1%	39.6%	30.2%	10.2%	5	4.25	1.02	225
Instructional technology										
All teacher respondents	2.0%	8.9%	23.0%	40.1%	21.1%	4.9%	15	3.84	1.07	734
Elementary teachers	3.6%	13.5%	27.9%	41.4%	13.1%	0.4%	12	3.48	1.01	251
Mathematics teachers	1.6%	6.7%	19.4%	38.7%	26.1%	7.5%	2	4.04	1.08	253
Science teachers	0.9%	6.1%	21.7%	40.0%	24.3%	7.0%	1	4.02	1.03	230

Ninety-three percent of all teacher respondents indicated that they had been somewhat effective to very effective in incorporating the standards overall, including almost two-thirds (62%) who thought they had been effective or very effective. Sixty-four percent of the science teachers rated themselves as effective or very effective, while a similar percentage of fewer elementary teachers (61%) and mathematics teachers (60%) rated themselves as effective. Only 4% or less rated themselves as ineffective in incorporating the standards.

All teacher respondents, elementary teachers, mathematics teachers, and science teachers gave proportionately similar ratings of effectiveness in incorporating mathematics and/or science standards related to instructional methods and curriculum changes. Over 50% of them felt they were effective or very effective, while less than 3% rated themselves as ineffective.

Teachers gave themselves lower ratings of effectiveness for incorporating mathematics and/or science standards related to assessment practices than they did for those standards related to instructional methods and curriculum change. Fewer than 40% of all teacher respondents felt they had been effective or very effective in incorporating standards related to assessment practices, while about 4% rated themselves as ineffective.

Teachers also rated their effectiveness in incorporating instructional technology in the classroom. Twenty-six percent of all teacher respondents felt that they were effective or very effective in incorporating technology. Seventeen percent of the elementary teachers rated themselves as ineffective, as compared to less than 10% of mathematics or science teachers.

Communication About Reform

Teachers were asked to indicate their communication about reform in mathematics and science with teachers in their districts, with teachers outside of their district, and with administrators. Although many Iowa teachers are using a standards-based mathematics and/or science curriculum, they are not

necessarily talking about it with their colleagues. Table 19 shows that few teachers communicate about reform in mathematics and science with other teachers in their districts; most as infrequently as a few times a year and only about 10% weekly.

Even fewer teachers communicate with teachers outside of their district. Fifty-two percent of the elementary teachers never communicate with other teachers about reform, while less than 40% of the mathematics teachers and science teachers never do. Over half of teachers communicate a few times a year with school administrators about reforms. About one-fourth never do.

How Teachers Incorporate the Standards Into Their Teaching

The survey of teachers provided detailed information about teachers' knowledge and the status of curriculum reform in mathematics and science in Iowa. For this section, survey questions addressed effectiveness of demonstration classrooms in helping teachers learn about reform, the types of reforms incorporated, and teacher inservice training in recent reforms. The following text and tables describe the results of these questions.

Data about the effectiveness of the demonstration classroom model came from the teacher surveys. Teachers were asked to report the effectiveness of the demonstration classroom as a model for staff development. This information is presented in Table 20.

Over 40% of both the elementary teachers and mathematics teachers indicated that demonstration classrooms are effective or very effective in helping teachers learn about reform. However, only one-third of the science teachers felt that way. Overall, 88% of the teachers responding reported that demonstration classrooms are effective (somewhat effective to very effective) in helping teachers learn about reform.

Many of the mathematics and science teachers (56% of all teachers combined) have incorporated changes in curriculum, instructional methods, and

Table 19. Frequency of Communication about Reform in Mathematics and Science

	Never	*A few times a year*	*Monthly*	*Weekly*	*Daily*	*N*
Communicate with teachers in your district about recent reforms in mathematics and/or science						
All teacher respondents	12.9%	46.5%	26.8%	11.6%	2.3%	751
Elementary teachers	16.3%	46.6%	24.2%	11.0%	1.9%	264
Mathematics teachers	10.9%	51.6%	25.0%	10.2%	2.3%	256
Science teachers	11.3%	40.7%	31.6%	13.9%	2.6%	231
Communicate with teachers outside of your district about recent reforms in mathematics and/or science						
All teacher respondents	41.0%	49.1%	6.8%	2.4%	0.8%	752
Elementary teachers	52.3%	41.3%	4.2%	1.1%	1.1%	264
Mathematics teachers	37.9%	50.0%	8.2%	3.1%	0.8%	256
Science teachers	31.5%	56.9%	8.2%	3.0%	0.4%	232
Communicate with administrators in your school about reforms in mathematics and/or science						
All teacher respondents	24.7%	53.6%	17.0%	3.9%	0.8%	752
Elementary teachers	24.6%	50.4%	18.6%	4.5%	1.9%	264
Mathematics teachers	25.8%	58.2%	12.9%	3.1%	0.0%	256
Science teachers	23.7%	52.2%	19.8%	3.9%	0.4%	232

Table 20. Effectiveness of Demonstration Classrooms in Helping Teachers Learn about Reform

	Very ineffective	*Ineffective*	*Somewhat ineffective*	*Somewhat effective*	*Effective*	*Very effective*	*Mean*	*S.D.*	*N*
Effectiveness of demonstration classrooms in helping teachers learn how to incorporate mathematics and science standards-based reforms in their own classrooms									
All teacher respondents	9.3%	3.9%	8.6%	37.0%	30.5%	10.6%	4.07	1.35	557
Elementary teachers	13.7%	1.4%	5.2%	33.2%	32.7%	13.7%	4.11	1.49	211
Mathematics teachers	5.9%	4.3%	10.8%	36.6%	33.9%	8.6%	4.14	1.22	186
Science teachers	7.5%	6.9%	10.6%	42.5%	23.8%	8.8%	3.94	1.29	160

Rating scale: 1=very ineffective, 2=ineffective, 3=somewhat ineffective, 4=somewhat effective, 5=effective, 6=very effective

assessment reforms consistent with the recent standards (Table 21). Fifty-eight percent of the elementary teachers responding reported that they have incorporated all three types of reforms, with another 15% incorporating changes in curriculum and assessment practices. Fifty-five percent of both the secondary mathematics teachers and science teachers reported that they are incorporating these types of reforms. Only 45 teacher respondents indicated that they had not incorporated any reforms.

Further, most teachers reported that they had participated in inservice training in recent mathematics and science reforms. About one-third of them noted a total amount of two to five days of training in the reforms (Table 22). An additional 13% reported one to two weeks of training, and 10% up to three non-consecutive weeks. A small percentage of teachers (2 to 3%) reported participating in inservice training in the reforms for at least three consecutive weeks, supplemented with additional training. Forty percent of the elementary and mathematics teachers had only one day of training or none at all. About one-fourth of the science teachers had no training in the reforms.

Teachers also reported that they are applying what they learned in these inservice opportunities in their classrooms (Table 23). About one-third indicated that they are using their new skills and knowledge some, and one-fourth use them quite a bit in their classrooms. Only 7% of the teachers are using their skills and knowledge about the reforms extensively in their classrooms. An additional one-fourth indicated that they have not applied what they learned in their classrooms.

Curriculum Revision

Teachers were asked a series of questions about curriculum revision and reforms in mathematics and science. These questions were related to teachers' familiarity with mathematics and science standards, when their last curriculum

Table 21. Types of Reforms Incorporated in the Classroom

	Curriculum changes only	*Assessment practices only*	*Instructional methods only*	*Curriculum changes and assessment practices*	*Curriculum changes and instructional methods*	*Assessment practices and instructional methods*	*All of three reforms (curriculum, assessment, and instruction)*	*N of valid responses*	*Number not incorporating any reforms*
Types of reform consistent with the recent mathematics and/or science standards that have been incorporated in your classroom.									
All teachers	4.7%	2.3%	1.7%	13.2%	13.3%	8.5%	56.2%	697	45
Elementary teachers	4.9%	2.0%	0.8%	15.1%	11.8%	6.9%	58.4%	245	17
Mathematics teachers	5.4%	2.5%	2.5%	9.6%	15.5%	9.2%	55.2%	239	12
Science teachers	3.8%	2.3%	1.9%	15.0%	12.7%	9.4%	54.9%	213	16

Table 22. Total Amount of Inservice Training in Recent Reforms

	None	*1 day only*	*2-5 days total*	*1-2 weeks total*	*3 weeks or more, not consecutively*	*3 consecutive weeks*	*3 consecutive weeks, plus additional training*	*N*
All teachers	26.4	13.4	34.5	12.8	10.3	0.1	2.6	740
Elementary teachers	25.7	14.9	36.4	11.1	9.2	0.4	2.3	261
Mathematics teachers	30.3	12.7	30.3	11.2	12.7	0.0	2.8	251
Science teachers	22.8	12.3	36.8	16.7	8.8	0.0	2.6	228

Table 23. Extent Teachers Applied Skills and Knowledge Learned in Inservice Training in the Classroom

	None	A little	Some	Quite a bit	Extensively	N
All teachers	23.4	14.0	31.5	24.6	6.5	723
Elementary teachers	22.7	11.3	29.7	28.5	7.8	256
Mathematics teachers	26.6	11.5	35.2	22.1	4.5	244
Science teachers	20.6	19.7	29.6	22.9	7.2	223

revision took place, their knowledge of the extent to which the reform standards were incorporated into that recent revision, district policy regarding adherence to the curriculum by individual teachers, information about the next planned curriculum revision, and teacher opinions on reform in mathematics and science. The responses from mathematics teachers are presented in Tables 24 through 29, and the responses from science teachers are presented in Tables 30 through 36.

Mathematics teachers. Mathematics teachers were asked to describe their familiarity with the national mathematics standards, such as the National Council of Teachers of Mathematics (NCTM) or MCREL, for both their own grade level and for all grade levels. Approximately 60% of elementary teachers reported being fairly to completely familiar with the standards at their grade level, while 41% indicated little or no knowledge of them (Table 24). Approximately 80% of secondary mathematics teachers reported being fairly to completely familiar with them, while only 22% indicated little or no knowledge of the standards at their grade level.

It is no surprise that mathematics teachers reported a higher level of familiarity with the standards at their own grade level than they did for all grade

Table 24. Mathematics Teachers' Familiarity with the National Mathematics Standards

	Don't know about them	*Know a little about them*	*Fairly familiar with them*	*Very familiar with them*	*Completely familiar with them*	*N*
Familiarity with the national mathematics standards (such as NCTM or MCREL) for your grade level						
Elementary teachers	7.6%	33.5%	33.1%	22.7%	3.2%	251
Mathematics teachers	2.8%	19.0%	40.9%	29.8%	7.5%	252
Familiarity with the national mathematics standards for all grade levels						
Elementary teachers	19.3%	54.7%	22.0%	3.5%	0.4%	254
Mathematics teachers	6.7%	45.2%	37.3%	10.3%	0.4%	252

levels. Almost 50% percent of the secondary mathematics teachers were fairly to completely familiar with the standards for all grade levels, while 26% of the elementary teachers were fairly or completely familiar with them. Conversely, over 70% of the elementary teachers reportedly knew little or nothing about the NCTM or MCREL standards for all grade levels.

Over half of both the elementary teachers and secondary mathematics teachers with valid responses indicated that the latest revision of their district's mathematics curriculum was within the last two years (Table 25). Less than 25% of the mathematics teachers reported a revision five or more years ago. The mathematics teachers also reported that approximately one-fourth of the mathematics curricula are currently under revision and another one-fourth are expected to be revised in the next two years.

Teachers also reported the extent to which the NCTM standards were incorporated into the most recent revision (Table 26). Approximately 50% of both elementary teachers and secondary mathematics teachers reported that the standards had been incorporated extensively. Further, 98% of the mathematics teachers reported that the standards would be incorporated into the next revision. Over 60% of the elementary teachers reported that their district policy regarding adherence to the mathematics curriculum by individual teachers is required, while 47% of the secondary mathematics teachers reported the policy to be suggested. Some teachers, 15% of the secondary mathematics teachers and 2% of the elementary teachers believed the policy is voluntary.

Mathematics teachers have strong opinions about mathematics reform (Table 27). Over 40% of the secondary mathematics teachers agreed or strongly agreed that they are well prepared to implement the NCTM standards in their classroom (mean=4.08, on a six-point scale), while about 13% disagreed. Elementary teachers were split, with 28% of the elementary teachers agreeing or

Table 25. Recent and Expected Mathematics Curriculum Revisions

	Last completed curriculum revision						*Expect the next curriculum revision*					
	Within the last year	*1 to 2 years ago*	*3 to 4 years ago*	*5 or more years ago*	*N of valid responses*	*Number don't know*	*Currently under revision*	*Within the next 1 to 2 years*	*Within the next 3 to 4 years*	*Within thenext 5 years*	*N of valid responses*	*Number don't know*
Elementary teachers	23.9%	28.0%	27.1%	21.1%	218	34	26.2%	28.0%	22.6%	23.2%	168	84
Mathematics teachers	25.7%	31.2%	27.1%	16.1%	218	34	26.6%	24.3%	25.4%	23.7%	177	75

Table 26. Incorporation of National Mathematics Standards in Mathematics Curriculum

	NCTM standards in last curriculum revision						*NCTM standards in next curriculum revision*				*Policy for adhering to math curriculum*			
	Yes,extensively	*Yes, somewhat*	*Yes, a ittle*	*No*	*N of valid responses*	*Number don't know*	*Yes*	*No*	*N of valid responses*	*Number don't know*	*Required*	*Suggested*	*Voluntary*	*N of valid responses*
Elementary teachers	51.8%	38.1%	6.6%	3.6%	197	54	98.2%	1.8%	163	83	64.1%	33.5%	2.4%	245
Mathematics teachers	47.1%	35.0%	11.7%	6.3%	206	46	97.5%	2.5%	157	92	38.2%	46.7%	15.0%	246

Table 27. Mathematics Teachers' Opinions on Mathematics Reform

	Strongly disagree	*Disagree*	*Somewhat disagree*	*Somewhat agree*	*Agree*	*Strongly agree*	*Mean*	*S.D.*	*N*
I feel well prepared to implement the NCTM standards in my classroom.									
Elementary teachers	6.4%	15.3%	14.5%	36.1%	24.1%	3.6%	3.67	1.27	249
Mathematics teachers	2.0%	11.2%	13.1%	30.7%	36.7%	6.4%	4.08	1.17	251
Reforms in mathematics have had a positive impact on student learning.									
Elementary teachers	2.0%	3.2%	12.9%	51.2%	25.4%	5.2%	4.10	0.95	248
Mathematics teachers	2.0%	9.2%	15.7%	48.6%	20.1%	4.4%	3.89	1.04	249

Rating scale: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree

strongly agreeing and 21% of the elementary teachers disagreeing that they are well prepared to implement mathematics standards.

Although many mathematics teachers reported that they are incorporating mathematics reforms into their curriculum, fewer agreed or strongly agreed that reforms in mathematics have had a positive impact on student learning (Table 27). Only one-fourth of secondary mathematics teachers and 31% of elementary teachers agreed. About half of these teachers somewhat agreed that reforms in mathematics have had a positive impact on student learning.

Mathematics teachers also responded to a question about how prepared they were to teach mathematics when addressing specific topics (Table 28). Elementary teachers reported that they were adequately prepared to teach mathematics when addressing the following topics:

- Iowa teaching standards (mean=3.56 on a five-point scale)
- Special needs of students (3.49)
- NCTM content standards (3.13)

Secondary mathematics teachers reported that they were adequately prepared to teach the following topics:

- Iowa teaching standards (3.46)
- NCTM content standards (3.43)
- NCTM process standards (3.22)

About one-fourth to one-third of elementary teachers reported that they were inadequately prepared to teach to the NCTM content (26%) and process standards (30%) and to address closing the achievement gap (28%). Similar percentages of mathematics teachers at the secondary level reported inadequate preparation in addressing special needs of students (30%) and closing the achievement gap (33%), as well as teaching to both NCTM content (22%) and process standards (26%).

Table 28. Mathematics Teachers' Report of their Adequacy of Preparation When Addressing Specific Topics

	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*S.D.*	*N*
Iowa teaching standards								
Elementary teachers	3.4%	11.8%	23.1%	48.7%	13.0%	3.56	0.97	238
Mathematics teachers	4.3%	15.5%	22.8%	44.8%	12.5%	3.46	1.04	232
Special needs of students								
Elementary teachers	2.4%	14.1%	25.4%	48.0%	10.1%	3.49	0.94	248
Mathematics teachers	3.2%	26.3%	27.5%	38.1%	4.9%	3.15	0.97	247
NCTM content standards								
Elementary teachers	5.5%	20.4%	33.6%	36.6%	3.8%	3.13	0.97	235
Mathematics teachers	2.9%	17.8%	24.0%	44.2%	11.2%	3.43	1.00	242
NCTM process standards								
Elementary teachers	6.0%	24.0%	40.8%	25.8%	3.4%	2.97	0.94	233
Mathematics teachers	3.4%	22.3%	31.1%	35.3%	8.0%	3.22	0.99	238
Closing the achievement gap								
Elementary teachers	7.2%	22.5%	39.4%	28.8%	2.1%	2.96	0.94	236
Mathematics teachers	6.2%	26.5%	39.4%	25.2%	2.7%	2.92	0.93	226

Rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

Differences in responses due to years of teaching experience[3] was also examined for this question. It is evident that years of teaching experience make some difference in the responses of teachers regarding their preparation to address these key topics in mathematics (Table 29). For one item, teachers with more than 20 years of teaching experience indicated a higher adequacy of preparation for incorporating the NCTM process standards.

Science teachers. Science teachers were also asked to describe their familiarity with the National Science Education Standards (NSES), for both their own grade level and for all grade levels. Only one-third of elementary teachers reported being fairly to completely familiar with the science standards at their grade level, while 67% indicated little or no knowledge of them (Table 30). A much higher percentage of secondary science teachers (72%) reported being fairly to completely familiar with them, while only 28% indicated little or no knowledge of the standards at their grade level.

Like the mathematics teachers, science teachers reported a higher level of familiarity with the standards at their own grade level than they did for all grade levels. About 47% percent of the secondary science teachers and only 15% of the elementary teachers were fairly or completely familiar with the standards for all grade levels. Over half of the science teachers (54%) and 85% of the elementary teachers reportedly knew little or nothing about the NSES standards for all grade levels.

[3] Teachers were asked to indicate the number of years of teaching experience they had. Responses were received from 544 elementary and secondary mathematics and science teachers (72% of all teacher respondents) and ranged from one year to 39 years. The average number of years of teaching experience for these respondents was 18.9 years, above the state average in 2002 of 12.7 (Source: Iowa Department of Education, Bureau of Planning, Research, and Evaluation, Basic Educational Data Survey, Staff Files). For this analysis, years of teaching experience for 389 elementary teachers who teach mathematics and secondary mathematics teachers were combined into four categories, one to five years (14% of teachers), six to 10 years (14%), 11 to 20 years (26%), and more than 20 years (46%).

Table 29. Adequacy of Preparation When Addressing Specific Topics in Mathematics--Comparisons by Years of Teaching Experience

	Mean	*S.D.*	*N*	*F*	*Significance*	*Multiple comparisons of group differences*
Iowa teaching standards						
1-5 years	3.43	0.90	47	0.56	0.64	
6-10 years	3.35	1.16	48			
11-20 years	3.45	0.94	85			
More than 20 years	3.55	1.04	170			
Special needs students						
1-5 years	3.35	0.97	49	0.80	0.97	
6-10 years	3.27	0.94	51			
11-20 years	3.35	0.93	92			
More than 20 years	3.31	1.03	175			
NCTM content standards						
1-5 years	3.02	1.00	48	2.05	0.11	
6-10 years	3.12	1.02	50			
11-20 years	3.15	1.03	88			
More than 20 years	3.37	1.03	172			
NCTM process standards						
1-5 years	2.89	1.00	47	3.18	0.02	****
6-10 years	2.90	0.95	50			
11-20 years	2.88	0.99	86			
More than 20 years	3.21	0.96	171			
Closing the achievement gap						
1-5 years	2.91	0.92	46	0.75	0.52	
6-10 years	2.76	0.95	49			
11-20 years	2.84	0.95	85			
More than 20 years	2.96	0.95	161			

Rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

**** Post hoc test for group differences not definitive.

Table 30. Science Teachers' Familiarity with the National Science Education Standards

	Don't know about them	*Know a little about them*	*Fairly familiar with them*	*Very familiar with them*	*Completely familiar with them*	*N*
Familiarity with the National Science Education Standards (NSES) for your grade level						
Elementary teachers	24.1%	43.0%	22.8%	7.5%	2.6%	228
Science teachers	2.2%	25.4%	39.0%	25.4%	7.9%	228
Familiarity with the National Science Education Standards (NSES) for all grade levels						
Elementary teachers	39.9%	45.2%	8.8%	6.1%	0.0%	228
Science teachers	6.1%	47.4%	32.5%	12.3%	1.8%	228

Over half of both the elementary teachers and secondary science teachers with valid responses indicated that the latest revision of their district's science curriculum was within the last two years (Table 31). Only 24% of the elementary and 14% of the secondary science teachers reported the latest revision to be five or more years ago. Thirty percent of the science teachers indicated that the science curricula are currently under revision and another 27% are expected to be revised in the next two years. Few elementary teachers reported that their curricula are under revision at this time (16%). About 27% of the elementary teachers expect the next revision to be in the next two years.

Teachers also reported the extent to which the NSES standards were incorporated into the most recent revision (Table 32). Approximately one-third of both elementary teachers and secondary science teachers reported that the standards had been incorporated extensively. About three-fourths of these science teachers (82% of the secondary science teachers and 71% of the elementary teachers) reported that the standards would be incorporated into the next revision. Over 50% of the elementary teachers reported that their district policy regarding adherence to the science curriculum by individual teachers is required, while 45% of the secondary science teachers reported the policy to be required. Forty-two percent of both elementary and secondary science teachers reported the policy was suggested. Some teachers, 13% of the secondary science teachers and 4% of the elementary teachers, believed the policy is voluntary.

Science teachers also had strong opinions about science reform (Table 33). About 40% of the secondary science teachers agreed or strongly agreed that they are well prepared to implement the NCES standards in their classrooms (mean=4.07, on a six-point scale), while about 12% disagreed. A much smaller percentage of the elementary teachers agreed or strongly agreed (14%) that they are well prepared to implement science standards; one-third disagreed or strongly disagreed that they were well prepared.

Table 31. Recent and Expected Science Curriculum Revisions

	Last completed curriculum revision						*Expect the next curriculum revision*					
	Within the last year	*1 to 2 years ago*	*3 to 4 years ago*	*5 or more years ago*	*N of valid responses*	*Number don't know*	*Currently under revision*	*Within the next 1 to 2 years*	*Within the next 3 to 4 years*	*Within the next 5 years*	*N of valid responses*	*Number don't know*
Elementary teachers	17.4%	30.9%	28.1%	23.6%	178	50	16.4%	26.6%	31.3%	25.8%	128	101
Science teachers	30.0%	37.5%	19.0%	13.5%	200	26	30.2%	27.0%	24.5%	18.2%	159	68

Table 32. Incorporation of National Science Education Standards in Science Curriculum

	NSES standards in last curriculum revision						*NSES standards in next curriculum revision*				*Policy for adhering to science curriculum*			
	Yes,extensively	*Yes, somewhat*	*Yes, a ittle*	*No*	*N of valid responses*	*Number don't know*	*Yes*	*No*	*N of valid responses*	*Number don't know*	*Required*	*Suggested*	*Voluntary*	*N of valid responses*
Elementary teachers	36.6%	45.5%	11.6%	6.3%	112	115	71.4%	28.6%	168	47	53.4%	42.5%	4.1%	219
Science teachers	36.4%	40.5%	13.9%	9.2%	173	54	82.1%	17.9%	184	42	45.0%	42.3%	12.7%	220

Table 33. Science Teachers' Opinions on Science Reform

	Strongly disagree	*Disagree*	*Somewhat disagree*	*Somewhat agree*	*Agree*	*Strongly agree*	*Mean*	*S.D.*	*N*
I feel well prepared to implement in my classroom the recommendations for science reform as outlined in the National Science Education Standards.									
Elementary teachers	11.7%	20.6%	22.4%	30.9%	11.2%	3.1%	3.19	1.30	223
Science teachers	2.7%	9.7%	15.5%	35.0%	24.3%	12.8%	4.07	1.24	226
Reforms in science have had a positive impact on student learning.									
Elementary teachers	2.7%	5.9%	15.5%	50.9%	21.4%	3.6%	3.93	1.00	220
Science teachers	2.7%	9.8%	12.9%	49.3%	18.2%	7.1%	3.92	1.11	225

Rating scale: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree

Although many science teachers reported that they were incorporating science reforms into their curriculum, only about one-fourth agreed or strongly agreed that reforms in science have had a positive impact on student learning (Table 33). Like the mathematics teachers, about half of the teachers (50%) somewhat agreed that reforms in science have had a positive impact on student learning.

Science teachers also responded to a question about how prepared they were to teach science when addressing specific topics, as well as another question regarding preparation to teach specific science subjects (Tables 34 and 35). In Table 34, elementary teachers reported that they were adequately prepared to teach the following topics:

- Safety concerns in the classroom (mean=3.58 on a five-point scale)
- Special needs of students (3.44)
- Improved reading and writing skills through science teaching (3.33)
- Inquiry-based learning (3.28)

Secondary science teachers reported that they were adequately prepared to teach the following topics:

- Safety concerns in the classroom (3.85)
- Inquiry-based learning (3.74)
- Iowa teaching standards (3.36)
- Special needs of students (3.32)
- National Science Education Standards (3.28)

About one-fourth to one-third of elementary teachers reported that they were inadequately prepared to teach to the NSES (41%) and the Iowa teaching standards (32%) and use inquiry-based learning (24%), as well as to address closing the achievement gap (33%) and improving reading and writing skills

Table 34. Science Teachers' Report of their Adequacy of Preparation When Addressing Specific Topics

	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*S.D.*	*N*
Safety concerns in the lab/classroom								
Elementary teachers	2.4%	10.7%	25.2%	49.5%	12.1%	3.58	0.92	206
Science teachers	3.5%	14.2%	7.5%	43.8%	31.0%	3.85	1.12	226
Iowa teaching standards								
Elementary teachers	5.7%	25.8%	23.0%	35.9%	9.6%	3.18	1.10	209
Science teachers	5.0%	20.3%	23.9%	35.6%	15.3%	3.36	1.12	222
Special needs of students								
Elementary teachers	1.8%	17.8%	25.6%	44.3%	10.5%	3.44	0.96	219
Science teachers	3.5%	19.4%	27.8%	40.1%	9.3%	3.32	1.00	227
Inquiry-based learning								
Elementary teachers	6.1%	17.9%	27.8%	38.2%	9.9%	3.28	1.06	212
Science teachers	2.2%	9.4%	21.5%	45.3%	21.5%	3.74	0.97	223
National Science Education Standards								
Elementary teachers	10.7%	30.6%	29.6%	25.2%	3.9%	2.81	1.05	206
Science teachers	6.8%	22.7%	20.0%	36.8%	13.6%	3.28	1.16	220
Improving reading and writing skills through science teaching								
Elementary teachers	4.2%	19.5%	24.7%	42.8%	8.8%	3.33	1.02	215
Science teachers	5.8%	25.2%	28.8%	31.0%	9.3%	3.13	1.07	226
Closing the achievement gap								
Elementary teachers	8.0%	24.5%	38.0%	26.0%	3.5%	2.93	0.98	200
Science teachers	5.2%	23.0%	40.4%	27.7%	3.8%	3.02	0.93	213

Rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

through science teaching (24%). An additional 20% of elementary teachers were inadequately prepared to address the special needs of students.

A similar percentage of science teachers at the secondary level reported inadequate preparation in addressing special needs of students (23%) and closing the achievement gap (28%), as well as teaching to both the national standards (30%) and the Iowa teaching standards (25%). Thirty-one percent of secondary science teachers reported that they were inadequately prepared to use science teaching to improve reading and writing skills.

In addition, science teachers were split, reporting that their teacher preparation programs had adequately prepared them to teach specific science subjects (Table 35). Approximately 50% of elementary teachers reported adequate preparation in the following subjects—life science (59%), physical science (51%), earth/space science (50%), and environmental science (45%); and another one-fourth to one-third reported a neutral rating of their preparation. Fifty percent of elementary teachers reported inadequate preparation for teaching chemistry and physics, as did 35% for biology.

As expected, a higher percentage of secondary science teachers reported that they had adequate preparation in science subjects. More than half of the secondary science teachers reported adequate preparation in the following subjects—life science (79%), physical science (77%), biology (77%), environmental science (68%), chemistry (61%), earth/space science (55%), and physics (50%). Conversely, over 20% of secondary science teachers reported inadequate preparation in physics (29%), earth/space science (21%), and chemistry (21%). About 10% of the science teachers indicated inadequate preparation in the remaining subject areas.

Like the mathematics teachers, years of teaching experience[4] contributed

[4] For this analysis, years of teaching experience for 502 elementary teachers who teach science and secondary science teachers were combined into four categories, one to five years (14% of teachers), six to 10 years (13%), 11 to 20 years (28%), and more than 20 years (45%).

Table 35. Science Teachers' Attitude Toward their Teacher Education Program Preparation in Specific Science Subject Areas

	Very inadequate	*Inadequate*	*Neutral*	*Adequate*	*Very adequate*	*Mean*	*S.D.*	*N*
Biology								
Elementary teacher	15.1%	19.5%	27.3%	31.7%	6.3%	2.95	1.17	205
Science teacher	5.4%	8.9%	8.9%	32.6%	44.2%	4.01	1.17	224
Chemistry								
Elementary teacher	21.7%	28.8%	28.3%	19.7%	1.5%	2.51	1.08	198
Science teacher	3.2%	17.6%	18.6%	35.3%	25.3%	3.62	1.14	221
Physics								
Elementary teacher	21.7%	28.3%	30.3%	17.7%	2.0%	2.50	1.08	198
Science teacher	10.8%	18.3%	21.1%	31.9%	17.8%	3.28	1.26	213
Earth/space science								
Elementary teacher	7.5%	12.7%	29.6%	44.6%	5.6%	3.28	1.01	213
Science teacher	5.1%	16.1%	23.5%	35.9%	19.4%	3.48	1.13	217
Physical science								
Elementary teacher	8.5%	12.3%	28.0%	45.5%	5.7%	3.27	1.04	211
Science teacher	4.5%	7.6%	10.8%	42.6%	34.5%	3.95	1.08	223
Life science								
Elementary teacher	6.6%	11.3%	23.1%	50.5%	8.5%	3.43	1.02	212
Science teacher	4.4%	7.1%	9.3%	32.9%	46.2%	4.09	1.11	225
Environmental science								
Elementary teacher	10.0%	14.8%	30.5%	38.6%	6.2%	3.16	1.08	210
Science teacher	3.6%	9.1%	19.1%	44.1%	24.1%	3.76	1.03	220

Rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

to some differences in the responses of science teachers regarding their preparation to address these key topics in science (Table 36). In two areas—inquiry-based learning and Iowa teaching standards—there were differences by years of teaching experience. Teachers with five or fewer years of experience reported that they were more adequately prepared to incorporate inquiry-based learning into their classrooms than were teachers with six to 10 years and 11 to 20 years of teaching experience. Teachers with more than 20 years of experience reported that they were better prepared to incorporate Iowa teaching standards than were teachers with 11 to 20 years of experience. It is interesting to note for this item (Iowa teaching standards) that teachers with five or fewer years of experience rated themselves as most adequately prepared of the four groups; significant differences were not evident, however, likely due to the small sample size. There were no significant differences in adequacy of preparation to teach specific science subjects when comparing years of teaching experience (Table 36).

In an open-ended question, science teachers were asked to indicate improvements that could address inadequacies in their teacher preparation or certification programs. Several elementary teachers noted that they did not have any in-depth training in biology, chemistry, physics, earth/space science, physical science, life science, and environmental science. They reported that these subjects were not core classes, but should have been required. One respondent wrote that [I needed] *more methods courses and opportunities, such as practicum experiences to expand effective science teaching strategies and content area study*.

Superintendents. This section of the report includes information provided by the superintendents about mathematics and science curriculum structure and revision in their districts. The superintendents were asked to provide information about (1) their familiarity with current reform standards and recommendations in mathematics and science, (2) when the last revision of the

Table 36. Adequacy of Preparation When Addressing Specific Topics and Subject Areas in Science--Comparisons by Years of Teaching Experience

	Mean	*S.D.*	*N*	*F*	*Significance*	*Multiple comparisons of group differences*
Safety concerns in the lab/classroom						
1-5 years	3.88	0.93	41	0.66	0.58	
6-10 years	3.82	1.01	38			
11-20 years	3.64	1.07	91			
More than 20 years	3.69	1.06	137			
Iowa teaching standards						
1-5 years	3.44	1.14	41	3.12	0.03	3 vs 4
6-10 years	3.08	1.22	39			
11-20 years	2.92	1.10	86			
More than 20 years	3.31	1.06	137			
Special needs of students						
1-5 years	3.52	0.88	44	0.84	0.47	
6-10 years	3.20	1.09	40			
11-20 years	3.35	1.00	91			
More than 20 years	3.28	1.07	139			
Inquiry-based learning						
1-5 years	3.81	0.85	43	3.58	0.01	1 vs 2, 3
6-10 years	3.20	1.20	40			
11-20 years	3.24	1.18	86			
More than 20 years	3.49	0.98	138			
National Science Education Standards						
1-5 years	3.21	1.12	42	1.71	0.16	
6-10 years	2.90	1.21	39			
11-20 years	2.77	1.14	86			
More than 20 years	3.04	1.16	133			

Rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

Table 36. (continued)

	Mean	*S.D.*	*N*	*F*	*Significance*	*Multiple comparisons of group differences*
Improving reading and writing skills through science teaching						
1-5 years	3.39	0.84	44	0.86	0.46	
6-10 years	3.13	1.07	40			
11-20 years	3.09	1.12	91			
More than 20 years	3.11	1.14	135			
Closing the achievement gap						
1-5 years	3.15	0.92	40	1.49	0.22	
6-10 years	2.73	0.99	37			
11-20 years	2.82	0.96	83			
More than 20 years	2.88	0.95	128			
Biology						
1-5 years	3.60	1.34	42	0.53	0.66	
6-10 years	3.24	1.28	38			
11-20 years	3.41	1.34	88			
More than 20 years	3.47	1.31	136			
Chemistry						
1-5 years	3.38	1.04	42	1.78	0.15	
6-10 years	2.86	1.33	35			
11-20 years	2.92	1.26	86			
More than 20 years	3.14	1.28	132			
Physics						
1-5 years	3.02	1.04	41	0.67	0.57	
6-10 years	2.83	1.25	35			
11-20 years	2.75	1.22	81			
More than 20 years	2.94	1.24	132			

Table 36. (continued)

	Mean	*S.D.*	*N*	*F*	*Significance*	*Multiple comparisons of group differences*
Earth/space science						
1-5 years	3.40	0.91	42	0.20	0.90	
6-10 years	3.23	1.09	39			
11-20 years	3.33	1.05	89			
More than 20 years	3.34	1.40	131			
Physical science						
1-5 years	3.74	0.73	42	1.43	0.24	
6-10 years	3.49	1.21	39			
11-20 years	3.43	1.20	89			
More than 20 years	3.70	1.10	135			
Life science						
1-5 years	3.91	0.87	43	0.90	0.44	
6-10 years	3.85	1.01	39			
11-20 years	3.61	1.22	90			
More than 20 years	3.79	1.13	137			
Environmental science						
1-5 years	3.63	0.76	43	1.85	0.14	
6-10 years	3.51	1.12	39			
11-20 years	3.22	1.19	89			
More than 20 years	3.53	1.15	134			

mathematics and science curriculum occurred in their districts, (3) the extent to which reform standards and recommendations were incorporated into the most recent revisions of mathematics and science curricula in their districts, (4) when the next revisions in the mathematics and science curricula are planned for their districts, (5) district policy regarding adherence to the curricula by individual teachers, (6) methods used in staffing new courses in their districts within the past five years, and (7) departmentalization of mathematics and science at the elementary level in their districts. The results are presented in Tables 37 through 43.

Like mathematics and science teachers, superintendents were also asked to report their familiarity with the national mathematics standards, such as the NCTM or MCREL, and national science standards, such as the National Science Education Standards (NSES). The results are in Table 37. Approximately 80% of superintendents reported being fairly to completely familiar with the mathematics standards, while almost one-fourth indicated little or no knowledge of them. About 70% of superintendents reported being fairly to completely familiar with the science standards, while almost one-third indicated little or no knowledge of them. Overall, however, superintendents seem to be less familiar with the recommendations for science reform than they are with the standards for mathematics reform.

The superintendents were also asked to indicate the year in which their districts last completed a revision of the mathematics curriculum for the elementary, middle school/junior high, and high school levels (Table 38). Many of the superintendents reported that their mathematics curriculum at all three levels was revised within the last four years, with 80% reporting revisions of the mathematics curriculum for the elementary level, 81% for the middle school/junior high level, and 80% for the high school level during the years 1999 through 2002. Approximately 20% of the superintendents reported revisions between 1991 through 1998, with one superintendent reporting that the last

Table 37. Superintendents' Familiarity with Reform Standards

	Don't know about them	Know a little about them	Fairly familiar with them	Very familiar with them	Completely familiar with them	N
Mathematics standards	1.0	21.9	42.1	26.5	8.6	301
Science standards	3.0	29.0	39.4	23.2	5.4	297

Rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

Table 38. Year of Last Revision of Mathematics Curriculum as Reported by Superintendents

	Elementary		*Middle School/Junior High*		*High School*	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
1988	-	-	-	-	-	-
1989	-	-	1	0.4	-	-
1990	-	-	-	-	-	-
1991	1	0.4	-	-	-	-
1992	2	0.8	-	-	1	0.4
1993	-	-	-	-	-	-
1994	-	-	-	-	1	0.4
1995	6	2.4	6	2.5	5	2.1
1996	8	3.2	7	2.9	10	4.2
1997	13	5.2	13	5.5	14	5.9
1998	21	8.4	18	7.6	17	7.1
1999	35	13.9	40	16.8	39	16.4
2000	61	24.3	57	23.9	54	22.7
2001	54	21.5	48	20.2	50	21.0
2002	50	19.9	48	20.2	47	19.7
No response	52	-	65	-	65	-
Total	303	-	303	-	303	-

mathematics curriculum revision in his/her district for the middle school/junior high was in 1989.

In an open-ended question, superintendents commented on what their districts did to revise the mathematics curriculum. Among the 255 superintendents who responded, the most common comments were that they had researched current trends and best practices in mathematics education, as well as the NCTM standards and benchmarks and other models, and had studied other schools' web-based standards and benchmarks. These efforts resulted in incorporating the recommendations from the NCTM and McREL standards and benchmarks in their curricula. Some indicated that they have written standards and benchmarks for each grade level and for each class and subject area; reviewed and revised the scope and sequence chart; updated standards; aligned curriculum with instruction and assessment; and aligned local standards with national standards.

Further, many superintendents stated that the revision of the mathematics curriculum was done with the assistance of a curriculum committee that researched and reviewed the standards and benchmarks. The K-12 curriculum was reviewed by committees consisting of teachers, curriculum developers, AEA staff, parents, consultants or publisher representatives, and others, some who had attended workshops or in-service training led by AEA staff. Also, some stated that revisions were done by purchasing new materials, such as textbooks, and modern equipment. Fifteen respondents indicated that they were in the process or that they could not respond since they were not in the district when the revision of the mathematics curriculum was completed.

The superintendents also reported that the science curriculum at all three levels was generally last revised within the past four years, including 79% at the elementary level, 80% at the middle school/junior high level, and 81% at the high school level (Table 39). Approximately 20% of the superintendents reported their district's last revision at all three levels between 1994 through 1998. One

Table 39. Year of Last Revision of Science Curriculum as Reported by Superintendents

	Elementary		*Middle School/Junior High*		*High School*	
	Number	*Percent*	*Number*	*Percent*	*Number*	*Percent*
1988	1	0.4	-	-	-	-
1989	-	-	-	-	-	-
1990	-	-	-	-	-	-
1991	-	-	-	-	-	-
1992	-	-	-	-	-	-
1993	-	-	-	-	-	-
1994	1	0.4	1	0.4	1	0.4
1995	5	2.1	5	2.1	4	1.7
1996	8	3.3	9	3.8	6	2.6
1997	18	7.5	17	7.3	18	7.8
1998	17	7.1	16	6.8	15	6.5
1999	41	17.0	37	15.8	35	15.2
2000	37	15.4	41	17.5	39	16.9
2001	69	28.6	68	29.1	69	29.9
2002	44	18.3	40	17.1	44	19.0
No response	62	-	69	-	72	72.0
Total	303	-	303	-	303	-

superintendent reported that the science curriculum in his/her district for the elementary level was last revised in 1988.

Two hundred fifteen superintendents also responded to an open-ended question about what their districts did to revise the science curriculum. Their responses were consistent with those given for the question about revising the mathematics curriculum. Similarly they wrote that they had researched current trends and best practices in science education, the NSES standards and benchmarks and other models, and studied other schools' web-based standards and benchmarks, resulting in incorporating standards and benchmarks in their district curriculum. Some indicated that they have done curriculum mapping; written standards and benchmarks for each grade level and for each class and subject area; reviewed and revised the scope and sequence chart; updated standards; aligned standard and

benchmarks with instruction and assessment; and aligned local standards with national standards.

Further, many superintendents stated that, like for mathematics, the revision of the science curriculum was done with the assistance of a curriculum committee that researched and reviewed the standards and benchmarks, reviewed the K-12 curriculum, or purchased new materials such as textbooks. Twelve respondents indicated that they were in the process or that they were not in the district when the revision of the science curriculum was completed.

Presented in Table 40 is information about the extent to which national standards were incorporated into the most recent revision of the mathematics and science curricula in their districts. Ninety-eight percent of the superintendents reported that the national standards for mathematics were incorporated into the most recent revision of the curriculum in their districts, with 43% reporting that the standards were incorporated extensively into the revision, 44% that they were incorporated somewhat, and 10% that they were incorporated a little. Three percent of the superintendents responded that the standards were not incorporated, and 3% indicated that they did not know if they were incorporated.

A similar percent of the superintendents (93%) reported that science standards were incorporated into their district's most recent science curriculum revision, with 31% reporting that the recommendations were incorporated extensively, 47% that they were incorporated somewhat, and 15% that they were incorporated a little. Seven percent reported that the science standards were not incorporated into the last curriculum revision in their districts, and 58 superintendents responded that they did not know if the standards were incorporated.

The superintendents were asked to report when they expect the next revision of the mathematics and science curriculum in their districts to occur. The results are presented in Table 40. Approximately three-fourths of the superintendents reported that they expect the next curriculum revision for both mathematics and science

Table 40. Incorporation of National Standards in Mathematics and Science Curriculum--Responses by Superintendents

	National standards in last curriculum revision						*Expect the next curriculum revision*				
	Yes, extensively	*Yes, somewhat*	*Yes, a little*	*No*	*N of valid responses*	*Number don't know*	*Within the next 1-2 years*	*Within the next 3 to 4 years*	*Within thenext 5 years*	*N of valid responses*	*Number don't know*
Mathematics curriculum	42.9%	44.3%	10.3%	2.5%	282	9	31.9%	40.3%	27.8%	263	18
Science curriculum	30.9%	47.0%	15.2%	7.0%	230	58	26.2%	46.4%	27.3%	267	17

to occur within the next four years. Approximately 27% responded that they expect the next mathematics and science curriculum revision to occur in five or more years.

When asked to indicate the district policy regarding adherence to the mathematics and science curriculum by individual teachers, 75% of the superintendents reported that adherence to the mathematics curriculum is required, 22% reported that it is suggested, and three percent reported that adherence is voluntary (Table 41). For science, 73% of the superintendents responded that their districts require teachers to adhere to the science curriculum, 24% reported that adherence is suggested, and three percent that adherence is voluntary.

The superintendents also were asked to indicate whether their districts have added any mathematics or science courses during the last five years, and, if so, to indicate how the district staffed these new courses. The results are presented in Table 42. One hundred seventy-eight responding superintendents indicated that their districts added mathematics courses during the past five years, and 137 reported that their districts added science courses during this time. Since respondents could check more than one method of staffing, the data in the table reflect the percent of respondents who checked a method of staffing new courses.

Of the 178 superintendents who reported adding new mathematics courses, 39% indicated that they reassigned current teachers to the new courses, and 34% staffed the courses by having current teachers teach additional periods or subjects. Twenty-four percent of the superintendents reported that mathematics courses were added because of enhanced/expanded/revised curriculum, student needs, and the ICN, while 6% hired more teachers. New staff came about as a result of participation in whole-grade sharing or district reorganization or consolidation for about 3% percent of the cases.

Table 41. District Policy Regarding Adherence to Curriculum by Individual Teachers as Reported by Superintendents

	Policy for adhering to math curriculum			
	Required	*Suggested*	*Voluntary*	*N of valid responses*
Mathematics teachers	75.0%	22.3%	2.7%	296
Science teachers	73.2%	23.7%	3.1%	295

Table 42. Methods Used by Superintendents in Staffing New Mathematics and Science Courses within the Last Five Years

	Mathematics		*Science*	
	Number	*Percent of cases (N=178)*	*Number*	*Percent of cases (N=137)*
Hired more teachers	10	5.6	5	3.6
Current teachers taught additional periods/subjects	61	34.3	51	37.2
Reassigned current teachers	69	38.8	50	36.5
Participated in whole-grade sharing	3	1.7	2	1.5
Reorganized/consolidated district	3	1.7	1	0.7
Other	42	23.6	31	22.6

Of the 137 superintendents who reported that their districts added science courses during the past five years, the majority (74%) reported that they staffed the courses by having current teachers teach additional periods or by reassigning current teachers. Twenty-three percent reported that science courses were added because of enhanced/expanded/revised curriculum and student needs, while 4% hired more teachers. Approximately 2% reported that their district staffed

the additional courses by participating in whole-grade sharing or by district reorganization or consolidation.

The superintendents were asked to report if their districts are departmentalized in mathematics and science at the elementary level, and, if so, for which grades. They also were asked to indicate if departmentalization at the elementary level is a district-wide goal. The results are presented in Table 43. Sixty-three percent of the superintendents reported that their districts are departmentalized at the elementary level. In those districts in which mathematics is departmentalized at the elementary level, the departmentalization occurs most often in grades 4, 5, and 6, with grades 5 and 6 mentioned by the majority of superintendents (89% and 67%, respectively).

Fifty-eight percent of the superintendents reported that their districts are departmentalized in science at the elementary level. In those districts where departmentalization occurs, like for mathematics, it most likely includes grades 4 (49%), 5 (87%), and 6 (61%), although a few superintendents reported departmentalization in science at grades 1, 2, and 3.

How Local Standards and Benchmarks Have Affected Student Achievement and Instructional Practices

Superintendents and AEA coordinators were asked to describe how the development of local standards and benchmarks have affected student achievement and instructional practices in mathematics and science. Table 44 shows the results. Both groups agreed that local standards and benchmarks have had a positive effect on both student achievement and instruction for mathematics and science. Approximately two-thirds of the superintendents and AEA coordinators believe they have had a positive effect on student achievement, with about one-third seeing no effect. Between two-third and three-fourths of the superintendents and AEA coordinators have seen a positive effect on instructional practices, with the remainder noting no effect. Only one

Table 43. Departmentalization of Elementary Grades in Mathematics and Science as Reported by Superintendents

	Mathematics		*Science*			*Mathematics*		*Science*	
	Number	*Percent*	*Number*	*Percent*		*Number in each grade*	*Percent of cases (N=111)*	*Number in each grade*	*Percent of cases (N=127)*
Elementary Departmentalization					Grades Departmentalized				
Departmentalization	191	63.2	174	57.8	Grade 1	3	2.7	4	3.1
Not departmentalized	111	36.8	127	42.2	Grade 2	3	2.7	5	3.9
Not specified	1	-	2	-	Grade 3	10	9.0	16	12.6
Total	303	-	303	-	Grade 4	52	46.8	62	48.8
					Grade 5	99	89.2	110	86.6
					Grade 6	74	66.7	77	60.6

Table 44. Effect of Local Standards and Benchmarks on Student Achievement and Instructional Practices

	Student achievement in mathematics				*Student achievement in science*				*Instructional practices in mathematics*				*Instructional practices in science*			
	Positive effect	*Negative effect*	*No effect*	*N*	*Positive effect*	*Negative effect*	*No effect*	*N*	*Positive effect*	*Negative effect*	*No effect*	*N*	*Positive effect*	*Negative effect*	*No effect*	*N*
Superintendents	61.5	1.4	31.2	292	65.1	1.4	33.6	292	75.0	1.0	24.0	219	71.1	1.0	27.8	291
AEA coordinators	63.2	0.0	36.8	19	60.0	0.0	40.0	20	67.5	0.0	33.3	18	75.0	0.0	25.0	20

percent of the superintendents believed local standards and benchmarks have had a negative effect on student achievement and instructional practices. No AEA coordinators indicated a negative effect.

In an open-ended question, mathematics teachers commented how the development of their district standards and benchmarks affected their teaching and student achievement. Among the 214 teachers who responded, 141 respondents commented that standards and benchmarks have had an effect on their teaching and on student achievement in their district. They stated that standards and benchmarks used as guidelines have helped them focus their teaching, made them more accountable in their teaching, made them aware of what they need to teach, and have better prepared them to assess their students. One mathematics teacher respondent wrote, [it helps me] *focus* [my] *teaching so that I'm not trying to cover everything*, and further commented that assessment data not only guide her teaching, but also help her students achieve where they need the most help.

Conversely, 63 respondents commented that district standards and benchmarks *have had little or no effect* on teaching or student achievement. Also, some respondents felt that the implementation of the standards and benchmarks was time consuming. One mathematics teacher wrote, *it has had little effect on the actual teaching and achievement* and *it has required more tests to be given*. As a result, this respondent indicated that they felt many teachers are too often teaching to the tests. Finally, ten respondents indicated that they did not know, were not sure, or that it was too early to tell whether district standards and benchmarks were making an impact.

Science teachers also commented how the development of their district standards and benchmarks affected their teaching and student achievement. Among the 192 teachers who responded, 140 commented that standards and benchmarks have had an effect on their teaching and on student achievement in their district. They mentioned that local standards and benchmarks have made

them aware of what they need to teach, have helped them focus their teaching, and have been implemented in their curriculum. One science teacher respondent wrote *that the development of . . . standards has given me guidance*.

Like the mathematics teachers, several of the science teachers responding (n=32) commented that district standards and benchmarks *have had little or no effect* on teaching or student achievement. Also, some felt that the implementation of the standards and benchmarks was time consuming. One science teacher wrote, *it has helped teachers that were new or substandard in coverage of curriculum*. As a result, this respondent indicated that the district standards and benchmarks did not change his or her teaching.

Further, many respondents stated that the implementation of standards and benchmarks have better prepared them to assess their students, and helped them to have a consistent curriculum with other teachers at their grade level. Twenty respondents indicated that they did not know, where not sure, or that it was too early to tell whether district standards and benchmarks were making an impact.

Best Ways To Assist Teachers in Incorporating Mathematics and Science Reform into Their Classrooms

In an open-ended question, teachers, superintendents, AEA mathematics and science coordinators commented on the best ways the Department of Education, the AEAs, local school districts, and higher education institutions can assist teachers in incorporating mathematics and science reform into their classrooms. Themes identified from each respondent group follow:

Elementary Teachers

- In-service
- Provide funding for resource materials
- Mentoring
- Allow for time
- Clearly defined standards

Secondary Math Teachers

- In-service
- Clearly defined standards
- Reduce teaching loads and teaching of multiple subjects
- Increased communication and interaction with higher education institutions
- Funding for technology

Secondary Science Teachers

- Allow for time
- Increased funding
- Clearly defined standards
- Increased communication and interaction with higher education institutions
- In-service

Superintendents

- Hands on experience
- Time and funding so teachers can learn and practice reform
- In-service
- Mentoring
- Increase the use of AEA resources

AEA Coordinators

- Time and funding so teachers can learn and practice reform
- In-service
- Mentoring

Higher Education Faculty

- Professional development
- Mentoring
- Increased funding

There was agreement from all groups on a number of identified best ways for incorporating mathematics and science reform into the classroom. Themes mentioned by all groups included the need for time to practice or implement the reforms in the classroom, professional development opportunities, and funding. Other themes focused on mentoring, clearly defined standards, increased communication with educational partners, funding for technology, the role of

AEAs, hands-on experiences, and teacher preparation. The key findings from this question are presented by respondent group.

Teachers. Elementary and secondary mathematics teachers most often mentioned inservice and professional development as an effective way to assist teachers in incorporating mathematics and science reform into their classrooms. To complement the inservices, they wanted hands-on experiences. Examples of specific comments from teachers regarding hands-on experiences included these representative comments:

> *Demonstrations to actual students in actual classrooms. Teachers also learn by observation. Expose teachers to lots of modeling with real students at specific grade levels.*
>
> *Provide many opportunities to see how successful programs work. Provide classes that have theory and hands-on experience.*

Secondary mathematics teachers who listed inservices as a way to assist teachers wanted to make sure that they were directed specifically to their needs. Representative comments included:

> *. . .by designing inservices that would teach to science and math. It seems like a lot of inservices that we have deal with general teaching and political aspects of teaching.*
>
> *Inservices that demonstrate methods of teaching specific concepts. Our AEA provides website addresses – sometimes helpful, but very time consuming to sort through.*

Secondary science teachers identified the need for time as their number one way the IDOE, AEA, local school districts, and higher education institutions could help teachers in incorporating mathematics and science reforms. Specific comments from secondary science teachers included:

Somewhat leave us alone. Seriously, we spend so much time doing things for the DOE that we can never give our best to the actual instruction of kids. When I prepare meaningful lessons in Organic Chemistry, Chemistry I, and AP Chemistry daily, I just don't have time to do more DOE work on top of that. I will simply have to cut my preparation for daily instruction. Those at the DOE have no idea how much this is affecting our day-to-day efforts because they have no idea how much time it takes us to do their work.

Teachers need the time to see and be shown what the new reforms are. If it is truly a priority, then school districts need to provide time for science/math teachers to learn about the reforms.

Teachers need time to implement new programs. We get them shoved down our throats with no prep time to prepare. We would like to try to implement some new things, but when you teach four different subjects a day that becomes impossible.

All three groups of teachers responding agreed that clearly defining the standards of reform are important in assisting teachers with incorporating the math and science reform in the classroom. Additionally, teachers frequently suggested the need for state standards. One respondent stated:

We need state standards so that there is consistency when students move from district to district. It would make things better for those students…and for teachers working with those students. It would also make comparisons from districts across the state more relevant.

Teachers also identified the need for increased funding. Elementary teachers stated the need for funding for resource materials. Secondary mathematics teachers mentioned increased funding for technology needs in assisting in mathematics and science reform incorporation in the classroom. Secondary science teachers cited the need for increased funding in several areas, such as to attend in-services or classes or to purchase technology.

Both secondary mathematics and science teachers noted that higher education institutions could assist them through increased communication and interaction. Teachers cited a lack of confidence that higher education personnel

do not have a feel for what actually goes on in the classrooms. Examples of comments made:

> *. . . higher learning professors should be in the classrooms and see the reforms and change or adjust to the student learning.*
>
> *All areas must learn to communicate with each other. Currently, I feel that higher education institutions often have no clue as to what is really going on in the real world.*

Other ways that teachers noted how their educational partners can assist them in incorporating mathematics and science reform into their classrooms included mentoring, reducing the teaching loads and teaching assignments of multiple subjects, paying for graduate education, replacing ineffective AEAs, and providing incentives.

Superintendents. The most frequent response among superintendents for the best way to assist teachers in incorporating math and science reform into their classrooms was through the use of hands-on experience. Superintendents felt it was important to show teachers how to incorporate reform, instead of just telling them how to incorporate reform. Secondly, they indicated that time for in-service training was needed. Examples of specific comments regarding hands-on experience and time for training and practice included:

> *Provide examples and time to practice.*
>
> *Give examples – let teachers visit labs where real world application is being used.*
>
> *Teaching instructional skills and strategies via in-service over an extended period of time. The one-day workshop just doesn't have the impact we need.*
>
> *Provide teachers with time to work with content area specialists who are also experts on a variety of instructional strategies. Teachers must have opportunities to learn, implement, and reflect with other professionals.*

In addition to stating the need for allowing time for teachers to incorporate mathematics and science reform into their classroom, superintendents also cited the need for increased funding. These specific areas where increased funding is needed were suggested—to attend in-services, workshops and conferences; purchase resource materials; pay for further formal education; increase technology use; and offer incentives. Additional ways to assist teachers mentioned by superintendents included mentoring, increasing the role of AEAs in providing workshops and inservices and as a resource for materials and answering questions, developing a statewide plan for implementing the standards to increase consistency in implementation among districts, and requiring enhanced preparation in methods at the pre-service level.

AEA Mathematics and Science Coordinators. Three dominant themes were identified by AEA mathematics and science coordinators as ways to assist teachers in incorporating math and science reform into their classrooms—additional resources such as time and funding for teachers, inservice opportunities for teachers, and mentoring programs. AEA coordinators mentioned most often that teachers need to be allowed time to implement and incorporate math and science reform into their classrooms. One AEA respondent stated:

> *Moving toward reform takes time and a culture that allows for risk taking without penalty. Currently we are giving teachers neither of these.*

Secondly, AEA coordinators suggested the use of inservices in assisting teachers in incorporating math and science reform into their classroom. Follow-up training and continuing support for teachers was mentioned as key. One respondent provided this representative comment:

The best way we can assist teachers is to continue to offer high quality (best practices) courses, workshops, institutes, academies, and other professional development opportunities to all teachers. Schools also need assistance in finding the funding sources, so they can afford to attend such professional development activities. We need to make sure to keep the lines of communication open between all these agencies (i.e., DOE, AEAs, local school districts, and higher education institutions). We need to work together more often rather than having several of these agencies working on several separate projects to achieve basically the same goal. Why not consolidate our efforts and share our ideas?

Finally, AEAs noted the use of mentoring as another way to assist teachers in incorporating mathematics and science reform into their classroom. They suggested mentoring programs with peers or AEA personnel as likely mentors.

Higher Education Mathematics and Science Faculty. Higher educators identified four primary themes—professional development, mentoring, increased funding, and rethinking the role of AEAs. They most often wrote that professional development was the best way to assist teachers in incorporating mathematics and science reform into their classrooms. They cited inservices, workshops, conferences, and formal education as possible professional development opportunities. Examples of comments related to professional development include:

. . . through similar professional development programs, such as the Eisenhower grants, whereby, collaboration was encouraged and supported.

I've seen powerful things happen when teachers come back and take courses that require action research projects related to reform implementation. I believe graduate coursework must be valued and rewarded.

Not unexpectedly, the most commonly cited professional development opportunity suggested was for formal education. One higher education respondent stated:

Eliminate graduate credit through AEAs. It has diluted professional development to the point that it has no value. Offer graduate credit through actual programs, and work in cooperation with agencies. The last decade has been a dismal example of professional development for K-12 teachers.

Like teachers, superintendents, and AEA coordinators, higher education faculty also suggested mentoring programs and increasing funding for teachers to attend formal education and other professional development opportunities.

In summary, teachers, superintendents, AEA mathematics and science coordinators, and higher education gave similar recommendations on how the IDOE, the AEAs, local school districts, and higher education institutions could assist teachers in incorporating mathematics and science reform into their classrooms. In total, they suggested that providing effective and long-term professional development opportunities, providing funding for resources like substitutes, materials, technology, and mentoring programs so teachers can learn and practice reforms, more clearly defining standards for consistency across districts, and increasing and enhancing communication and interaction with higher education institutions and AEAs would be the best ways to assist teachers.

Integrating Environmental Education

Much of the environmental education taking place in Iowa is driven by the interests of individual teachers. Although state law mandates that science instruction shall include ". . . conservation of natural resources and environmental awareness. . ."[5] in grades 1-12, at this time there are few requirements and little continuity in schools, districts, or across the state. Integrating environmental education is seen to be an effective method of improving student interest and achievement, as well as reducing attendance and

[5] Source—Iowa Administrative Code, School Rules of Iowa [1281-12.5 (3,4,5)]

discipline problems. This survey included questions addressing environmental education to examine opinions of teachers, superintendents, AEA coordinators, and higher education faculty and understand the extent environmental education is integrated into district curricula across the state.

Questions related to environmental education included the importance of environmental education in the curriculum, whether it is incorporated into the curriculum, the percentage of time spent on environmental education topics during a school year, whether this time was sufficient, and how the Department of Education can assist with integration of environmental education. All four respondent groups provided information on this topic.

A majority of superintendents (98%) reported that environmental education was incorporated into the curriculum (Figure 15). Further, 61% thought it was an important or very important component of the curriculum (Figure 16).

About half of the teachers reported that they spend one to five percent of their time on environmental education during the school year, and another 30% spend six to ten percent of their time (Table 45). An additional 20% of the secondary science teachers spend more than 10% of their time on environmental education. Not surprisingly, only 39 mathematics teachers (15% of mathematics teacher respondents) answered this question. Teachers also reported whether this was a sufficient amount of time. They were split, with slightly over half (53%) indicating that it is sufficient, while 47% believe it is not (Figure 17).

Only 43% thought their professional development in incorporating environmental education into the curriculum was adequate or very adequate, while over 60% thought it was important or very important. For elementary teachers, this was an area of need for professional development. (See Table 13 in the section on Teacher Professional Development.)

Figure 15. Superintendents' Reporting that Environmental Education was Incorporated in the Curriculum

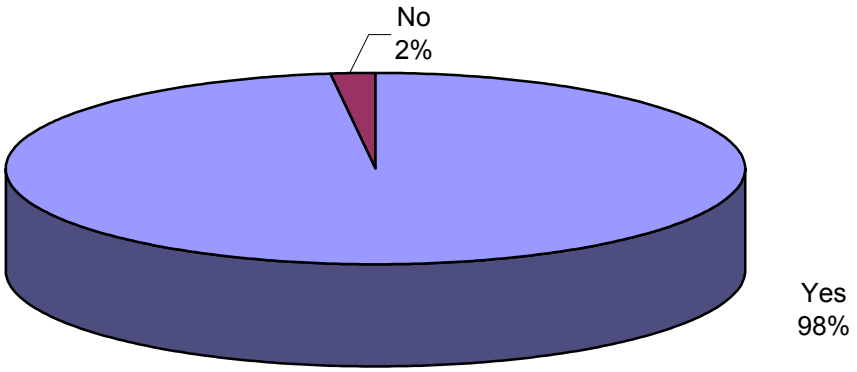


Figure 16. Superintendents' Reporting of Importance of Environmental Education in the Curriculum

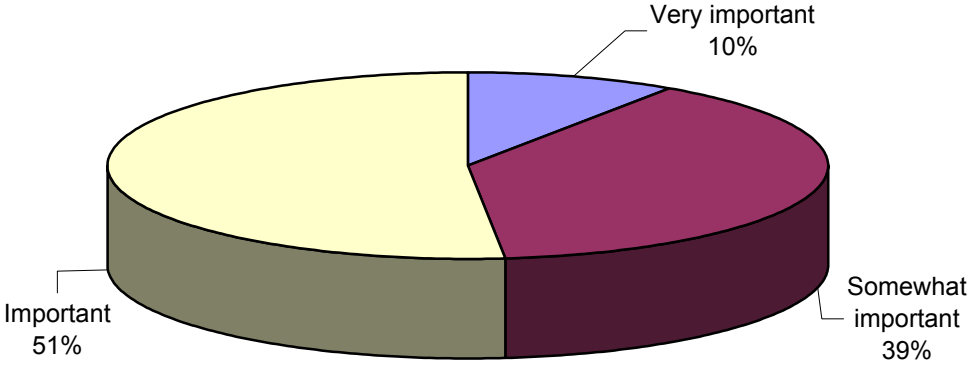
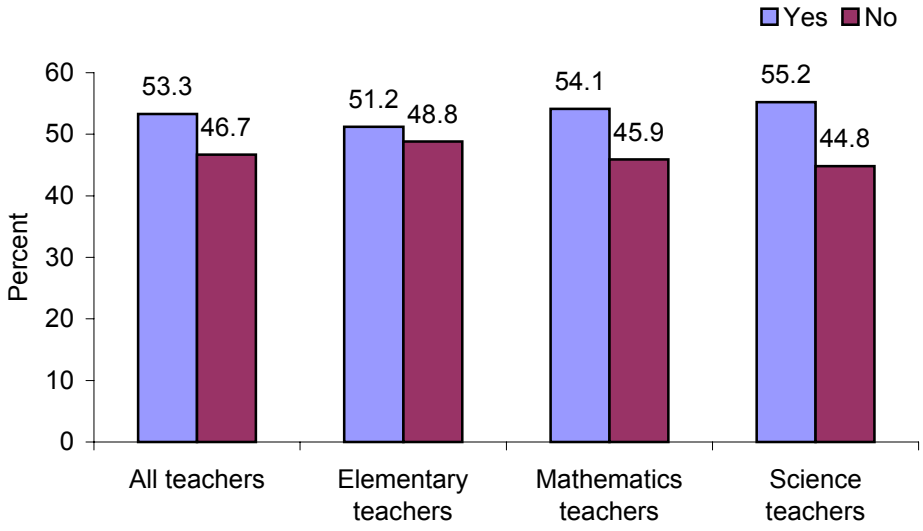


Table 45. Percentage of Time Spent by Teachers on Environmental Education During the School Year

	None	*1-5%*	*6-10%*	*More than 10%*	*N*
All teachers	6.1%	46.9%	29.7%	17.2%	488
Elementary teachers	5.4%	51.1%	28.7%	14.8%	223
Mathematics teachers	15.4%	43.6%	28.2%	12.8%	39
Science teachers	5.3%	43.4%	31.0%	20.4%	226

Figure 17. Percentage of Teachers Indicating that the Time Spent on Environmental Education is Sufficient



In an open-ended question, science teachers, superintendents, AEA coordinators, and higher education faculty wrote how the Iowa Department of Education (IDOE) could assist them with integrating environmental education. Their suggestions were consistent across the four groups, primarily addressing the need for materials, resources, and training; funding for programs and professional development; providing information on how to integrate environmental education into other required curriculum; and developing standards and benchmarks for environmental education.

Teachers, superintendents, and AEA coordinators recommended that the IDOE offer professional development opportunities to teachers, as well as materials, resources, and hands-on activities they can use in classrooms. Teachers are looking for age-based resources, with one teacher commenting that *knowing exactly what first graders are supposed to be learning about environmental education would be helpful*. Because teachers say that they have so many demands on their time and available funds, some want activities and hands-on experiences

that require little prep time and few materials. Superintendents suggested that the IDOE provide *meaningful materials and education to teachers at all levels and curriculum areas*, identify *exemplary programs*, provide *opportunities to be involved in pilot programs*, and find experts in environmental education *to provide guidance to local teachers*. AEA coordinators' comments were focused on the need for materials and training and recommended that the IDOE develop demonstration sites and web sites so that teachers could easily access activities and information, share research, provide exemplary models and frameworks, and identify quality curriculum.

Respondents to this question mentioned that the IDOE could provide funding. In particular, teachers and superintendents would request money to fund outdoor activities and field trips for their students, attend professional development opportunities (including college courses), pay for substitutes, and purchase supplies and materials. AEA and higher educators made general comments that funding was necessary.

A key request to the IDOE was for information and methods to integrate environmental education with other required curriculum areas. Teachers and superintendents agreed that there is often too little time in the established curriculum to add additional curriculum. One teacher summarized many teachers' comments, saying that *integration is the key. We can't add much more to the curriculum. Make materials more available at many different levels that can be integrated with reading and math* [and] with other science subjects like chemistry and physics. They recommended *sponsoring workshops that model activities integrating environmental education. . .* Another teacher wondered *how* [to] *incorporate these ideas in science not seemingly directly related to environment. I know they can be; the text and materials I have are not designed to incorporate environmental education*.

Another area that superintendents and teachers mentioned focused on standards and benchmarks. Some superintendents were unfamiliar with

standards and expectations for student learning in environmental education, saying, *I am not aware of materials that are available on environmental education that would help a district develop building level standards, benchmarks, and assessments covering environmental education*. They look to the IDOE to lead this effort or *to support/fund AEAs so they can help individual districts*. Some teachers were reluctant to teach environmental education topics since standardized tests contain few questions related to environmental education.

There were several teachers who felt that they were doing a good job of integrating environmental education topics into their curriculum. Others said that too many other subject areas took priority and there was just not enough time in the day for one more subject. Teachers and superintendents alike noted that there were too many requirements already and that they were having difficulty in meeting those current requirements. Several higher educators responding to this question indicated that it was not necessarily a priority for them as well. However, they suggested that the IDOE could assist teachers by requiring a course as part of licensure and encouraging local school administrators to integrate environmental education in their curricula.

Assessment

State legislation requires that multiple assessments be used in mathematics and science. For mathematics, reporting was required in 2001. For science, reporting is required in 2003. Teachers and superintendents were asked to indicate what other assessments they were using in addition to the Iowa Test of Basic Skills (ITBS) and/or the Iowa Test of Educational Development (ITED). The assessment categories were standardized tests, selected response, performance assessment (such as a portfolio or constructive response), a combination of selected response and performance assessment, or other as designated by the respondent. See Table 46 for their responses.

Currently, 63% of the elementary teachers and 47% of the secondary mathematics teachers use performance assessments or a combination of selected response and performance assessment as the format of their multiple assessments. Forty-seven percent of the superintendents reported that performance assessment or a combination of selected response and performance assessment are used in their districts as the format of the multiple assessments.

These groups listed the types of assessments used for mathematics. Assessments most often mentioned by both teachers and superintendents included the Iowa Collaborative Assessment Modules (ICAM), Mid-Iowa Achievement Level Tests, district- and AEA-development assessments, the New Standards Reference Exam, Exemplars, and NWEA. Examples of other assessments being used included STAR Math, Work Keys, Stanford 9, Curriculum Based Measurement, and criterion-reference tests.

For science, 69% of elementary teachers and 57% of secondary science teachers reported they use performance assessment measures or a combination of selected response and performance assessment as their second assessment in complying with state legislation. Fifty percent of the superintendents reported that performance assessment or a combination of selected response and performance assessment were used in their districts as the format of their multiple assessments (Table 46).

These groups listed the types of assessments being used in science. Assessments mentioned by the science teachers and superintendents were often similar to those mentioned for mathematics. The most often mentioned assessments for science included the Mid-Iowa Achievement Level Tests, PLAN/ACT, district-developed assessments, NWEA, and SCASS performance

Table 46. Frequency of Teachers' Second Assessment Used in Mathematics and Science

	Standardized test	*Selected response*	*Performance assessment*	*Combination selected response and performance assessment*	*Other*	*N*
State legislation requires that "multiple assessments" be used in the mathematics and reported in 2001. Besides the Iowa Test of Basic Skills and/or Test of Educational Development, check what best describes your second assessment.[a]						
Elementary teachers	20.8%	10.4%	23.8%	39.0%	6.1%	231
Mathematics teachers	30.8%	14.0%	16.8%	30.4%	7.9%	214
Superintendents	25.9%	12.1%	19.1%	27.7%	15.2%	282
State legislation requires that "multiple assessments" be used in the science and reported in 2003. Besides the Iowa Test of Basic Skills and/or Test of Educational Development, check what best describes your second assessment.[b]						
Elementary teachers	13.1%	11.6%	31.7%	37.7%	6.0%	199
Science teachers	19.4%	13.4%	16.1%	40.9%	10.2%	186
Superintendents	23.1%	10.8%	21.7%	28.2%	16.2%	277

[a]Note: Science teachers were excluded from this analysis.

[b]Note: Mathematics teachers were excluded from this analysis.

assessments. Examples of the others being used included Stanford 9, Work Keys, AEA-developed tests, chapter tests, criterion-referenced tests, Curriculum Based Measurement, class activities and assignments, and Exemplars.

Teacher Use of Technology in the Classroom

Teachers indicated their level of use of technology in the classroom (Table 47). Four questions in the teacher survey measured their use of electronic communication and the Iowa Communication's Network (ICN) for activities related to professional development and with their students.

Over 88% of all teachers indicated that they use electronic communication such as email or the internet daily. Fewer than 2% indicated they never used electronic communication. Although many Iowa teachers use electronic communication, they are not necessarily providing opportunities for their students to use it. Table 47 also shows that over half of all teachers indicated that they provide opportunities for their students to use electronic communication only a few times a year or less; about two-thirds of the secondary mathematics teachers and half of the elementary or secondary science teacher respondents were in this group. Conversely, about one-third of the secondary science teachers used email or internet with their students at least weekly, as did approximately one-fourth of the elementary and secondary mathematics teachers.

Teachers also indicated their level of use of the ICN (Iowa's fiber optic network). Table 48 shows that 63% of all teachers indicated that they had used the ICN for professional development activities. Despite their familiarity and use of the ICN for their own purposes, they had not necessarily used the ICN to provide instructional activities for their students. Over 75% of all teachers, including 84% of secondary mathematics teachers, indicated that they do not use the ICN for student instructional activities.

Table 47. Frequency of Use of Technology in the Classroom

	Never	*A few times a year*	*Monthly*	*Weekly*	*Daily*	*N*
Use electronic communication (e.g., internet, email)						
All teachers	0.9%	2.1%	1.9%	6.5%	88.5%	750
Elementary teachers	0.4%	2.7%	3.0%	8.7%	85.2%	264
Mathematics teachers	0.8%	0.8%	0.4%	5.1%	93.0%	256
Science teachers	1.7%	3.0%	2.2%	5.7%	87.4%	230
Provide opportunities for your students to use electronic communication						
All teachers	22.8%	29.9%	16.3%	20.2%	10.8%	749
Elementary teachers	23.2%	25.5%	16.3%	24.0%	11.0%	263
Mathematics teachers	30.1%	32.4%	12.9%	12.9%	11.7%	256
Science teachers	14.3%	32.2%	20.0%	23.9%	9.6%	230

Table 48. Frequency of Use of the ICN

	Yes	*No*	*N*
Have you used the ICN (Iowa's fiber optic network) for professional development activities (i.e., inservice, meetings, colleges classes)?			
All teachers	63.1%	36.9%	750
Elementary teachers	62.5%	37.5%	264
Math teachers	59.8%	40.2%	256
Science teachers	67.4%	32.6%	230
Have you used the ICN to provide instructional activities for your students (i.e., speakers, special events, courses)?			
All teachers	24.0%	76.0%	751
Elementary teachers	28.8%	71.2%	269
Math teachers	16.4%	83.6%	258
Science teachers	26.8%	73.2%	231

AEA Issues

The Area Education Agencies (AEA) are facing challenging issues, such as loss of funding and reorganization through merger. While their other educational partners may not directly face the particular challenges of the AEAs, these challenges affect the services and programs the AEAs can offer and deliver. Within this section, results for several items will be presented. These items include AEA plans to form a mathematics and science consortium using new district Title II funds, the effect of the loss of the Eisenhower funds on programming, how often mathematics and science supervisors and coordinators should meet to develop strategies and address educational issues, the effect that AEA reorganization would have on coordinators' positions, and how the AEAs and the Department of Education can work together to improve mathematics and science education.

AEA coordinators were somewhat divided in whether they anticipated forming a mathematics/science consortium using new Title II funding from the districts, with slightly more than half (58%) indicating that they did. All AEA respondents were concerned that the loss of the Eisenhower money would negatively impact them as coordinators, as well as the programs they provide (Figure 18). About one-third (35%) were somewhat concerned, while the remainder (65%) were very concerned.

AEA mathematics and science supervisors and coordinators meet periodically. In response to questions about how often they should meet, AEA respondents indicated that meetings coordinated by the Department of Education should be held two to three times per year (Table 49). Mathematics and science coordinators would like to meet an additional two times per year in meetings not necessarily coordinated by the Department of Education.

In an effort to reduce costs and consolidate services, several AEAs will merge in 2003. AEAs 5 and 3 will merge as of July 1, 2003, as will AEAs 2, 6, and 7. By mid 2003, the number of AEAs will be reduced to 12. It would seem

Figure 18. AEA Coordinators' Concern About Loss of Eisenhower Money

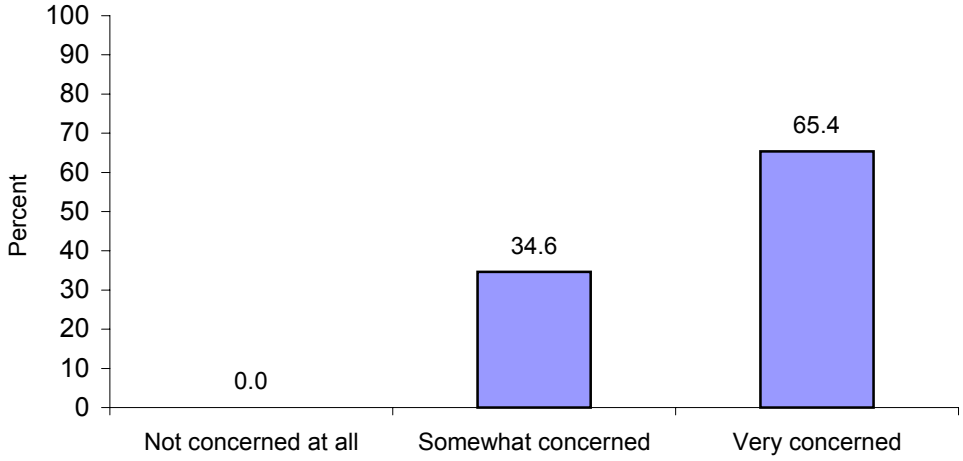


Table 49. Number of Times Mathematics/Science Supervisors Should Meet Annually--AEA Coordinator Responses

	Number of meetings								
	0	1	2	3	4	> 4	*Mean*	*S.D.*	*N*
How many times annually should there be a mathematics/science supervisors meeting coordinated by the Department of Education?	0	5	10	5	3	1	2.67	2.20	24
How many times annually should AEA mathematics and science coordinators meet separately (not necessarily coordinated by the Department of Education)?	2	5	9	6	2	0	2.04	1.08	24

likely that the mathematics and science coordinator positions would be affected by these mergers. Nineteen of 26 coordinators responded to an open-ended question about the effect of mergers on their positions.

While two of the respondents thought mergers would have no effect, over half of the AEA coordinators who answered this question were unclear how their positions would be affected, including those in merging AEAs. Several of the coordinators anticipated that they would have additional responsibilities and would likely serve more school districts. Others indicated that they would like to see the positions reorganized into specialized teams where individual

strengths could be utilized. One coordinator suggested that s/he would like to have responsibility for fewer districts so that quality services could be provided.

In another open-ended question, 24 of 26 mathematics and science coordinators responded and listed several ways that the AEAs and the Department of Education could to work together to improve mathematics and science education. First, they suggested that the Department of Education and the AEAs coordinate statewide efforts to provide real leadership by establishing collaborative goals with appropriate strategies and monitoring. This coordination could eliminate duplication of effort and promote the development of collaborative activities such as teacher study teams or grant procurement for state-wide or area-wide initiatives.

Second, they suggested that the Department of Education and the AEAs should coordinate inservice training across the state in areas of focus. These could be offered state-wide or regionally by the AEAs, using instate experts. Third, the coordinators wanted support for effective models like "Every Student Counts" and "The Science Co-op Packet," including training and inclusion in both planning and implementing models.

Fourth, providing effective communication between the Department of Education and the AEAs, as well as with local schools, was listed as a way to improve mathematics and science education. The AEA coordinators recommended that additional meetings are needed, *moving beyond the simple sharing information to going in depth on issues [such as] standards and benchmarks, aligning these with assessment and instruction, technical adequacy for assessments, various initiatives taking place in the AEAs, etc*. They want to learn about effective programs in other areas of the state, research-based instructional strategies, and recent legislation affecting math and science education. If the Department can provide information and training, the AEAs will network to share efforts and ideas. In a related issue, one AEA coordinator recognized that the role of the Department is often that of *enforcer of federal regulation*, a role that *consumes most*

of our relationship. They look to expand beyond that type of relationship if effective change is to occur.

Teacher Supply and Demand

To provide information about current supply and demand for mathematics and science teachers in Iowa, the superintendents were asked to report the number of teachers their districts will need to hire within the next five years, to indicate the degree of difficulty they anticipate in filling these positions, and the reasons for the vacancies they report. The information about supply and demand is presented in Tables 50 and 51. The number of superintendents responding to this section of the survey was 301.

In Table 50, information related to the number of teachers needed in the next five years to teach mathematics and science at the high school, middle school/junior high, and elementary levels, as well as the degree of difficulty anticipated in filling these positions is presented.

Supply and Demand for High School Mathematics Teachers

Superintendents reported that they anticipate hiring a total of 539 high school mathematics teachers within the next five years. Most of the new teachers will be hired to teach a combination of mathematics subjects (n=204), although some superintendents reported that they expect to hire teachers to teach in specific mathematics subject areas. These areas and the number of anticipated vacancies in each are algebra (n=104), geometry (n=79), statistics and probability (n=25), calculus (n=47), pre-calculus (n=39), trigonometry (n=37), and other subjects such as integrated math (n=4).

When asked to indicate the anticipated difficulty in filling high school mathematics positions, most of superintendents, who reported that their districts expected to hire, anticipated that it will be difficult to hire secondary

Table 50. Supply and Demand--High School Mathematics, High School Science, Middle School/Junior High Mathematics, Middle School/Junior High Science, and Elementary Teachers

	Number of teachers needed	Number of superintendents responding	Range of number of needed teachers	Percentage Anticipated Difficulty in Hiring[a]							
				No difficulty	Little difficulty	Some difficulty	Much difficulty	A great deal of difficulty	Number of responses	Mean	S.D.
High School Mathematics	539										
Algebra	104	75	1-6	1.3	9.3	32.0	25.3	30.7	74	3.76	1.04
Geometry	79	60	1-5	1.7	6.7	30.0	23.3	38.3	60	3.90	1.05
Statistics and probability	25	24	1-2	0.0	4.3	21.7	34.8	39.1	23	4.09	0.90
Calculus	47	41	1-4	2.5	2.5	10.0	27.5	57.5	40	4.35	0.95
Pre-calculus	39	34	1-4	0.0	6.1	15.2	33.3	45.5	33	4.18	0.86
Trigonometry	37	35	1-2	0.0	6.1	15.2	45.5	33.3	33	4.06	0.86
Combination of mathematics subjects	204	142	1-5	2.2	0.7	26.1	34.1	37.0	138	4.03	0.93
Other	4	3	1-2	0.0	0.0	66.7	0.0	33.3	3	3.67	1.15
High School Science	509										
Biology	78	68	1-4	1.5	4.5	34.8	31.8	27.3	66	3.79	0.95
Chemistry	74	66	1-4	0.0	6.2	12.3	36.9	44.6	65	4.20	0.89
Earth science	38	36	1-3	0.0	11.8	23.5	35.3	29.4	34	3.82	1.00
General science	35	33	1-2	0.0	9.4	31.3	34.4	25.0	32	3.75	0.95
Physical science	41	36	1-4	0.0	2.9	25.7	42.9	28.6	35	3.97	0.82
Physics	66	63	1-3	0.0	3.2	9.7	25.8	61.3	62	4.45	0.80
Combination of science subjects	168	129	1-7	2.5	2.5	23.0	24.6	47.5	122	4.12	1.01
Other	9	9	1-1	0.0	0.0	22.2	33.3	44.4	9	4.22	0.83
Middle School/Junior High Mathematics	220										
General mathematics	75	53	1-9	3.8	15.1	45.3	20.8	15.1	53	3.28	1.03
Pre-algebra/algebra	40	33	1-4	0.0	15.6	40.6	18.8	25.0	32	3.53	1.05
Combination of mathematics subjects	103	82	1-4	3.8	2.5	44.3	25.3	24.1	79	3.63	1.00
Other	2	2	1-1	0.0	0.0	50.0	50.0	0.0	2	3.50	0.71
Middle School/Junior High Science	249										
Life science	38	33	1-3	0.0	9.1	42.2	33.3	15.2	33	3.55	0.87
Earth science	27	24	1-2	0.0	4.2	54.2	25.0	16.7	24	3.54	0.83
Physical science	34	31	1-2	3.4	10.3	44.8	27.6	13.8	29	3.38	0.98
General science	39	26	1-10	3.8	7.7	42.3	30.8	15.4	26	3.46	0.99
Combination of science subjects	109	89	1-4	0.0	2.6	39.5	28.9	28.9	76	3.84	0.88
Other	2	2	1-1	0.0	0.0	50.0	50.0	0.0	2	3.50	0.71
Elementary	1559	226	1-100	28.4	45.0	24.8	1.8	0.0	222	2.00	0.78

[a]The response scale for anticipated difficulty in hiring includes: 1=no difficulty, 2=little difficulty, 3=some difficulty, 4=much difficulty, 5=a great deal of difficulty

mathematics teachers for all subject areas. Specifically, over 70% of the superintendents expected much difficulty or a great deal of difficulty in hiring teachers for calculus (85%), pre-calculus (79%), trigonometry (79%), and statistics and probability (74%), as well as those teachers who teach a combination of mathematics subjects (71%). Over half of the superintendents anticipated much to a great deal of difficulty in hiring geometry (62%) and algebra (56%) teachers at the high school level.

Supply and Demand for High School Science Teachers

At the high school level, the superintendents reported that they expect to hire a total of 509 science teachers within the next five years. About one-third of those (n=168) will be hired to teach a combination of science subjects, with another one-third hired to teach biology (n=78) or chemistry (n=74). Teachers are expected to be hired in other science areas, including physics (n=66), physical science (n=41), earth science (n=38), general science (n=35), and other science subjects such as physiology (n=9).

As with mathematics, most of superintendents, who reported that their districts expected to hire, anticipated difficulty in hiring science teachers for all subject areas. Specifically, over 70% of the superintendents expected much difficulty or a great deal of difficulty in hiring teachers for physics (87%), chemistry (82%), and physical science (72%), as well as those teachers who teach a combination of science subjects (72%). Over half of the superintendents anticipated much to a great deal of difficulty in hiring earth science (65%), general science (59%), and biology (59%) teachers at the high school level.

Supply and Demand for Middle School/Junior High Mathematics Teachers

The superintendents reported plans that included hiring a total of 220 mathematics teachers at the middle school/junior high level during the next five years, with 103 of these positions to be filled with teachers who will teach a

combination of mathematics subjects. New hires are also expected in general mathematics (n=75) and pre-algebra and algebra (n=40).

About half of the superintendents who reported that their districts will be hiring middle school/junior high mathematics teachers to teach general mathematics (36%), pre-algebra and algebra (44%), or a combination of mathematics subjects (49%) indicated that they expect have much to a great deal of difficulty in filling the positions. A similar percentage of superintendents (between 40 and 45%) also thought they would have some difficulty in filling the positions. In general, superintendents reported a likelihood of slightly less difficulty in hiring mathematics teachers for the middle school/junior high level than for the high school level.

Supply and Demand for Middle School/Junior High Science Teachers

The superintendents also reported that they anticipated filling 249 science positions at the middle school/junior high level within the next five years. About half of these positions are likely to be filled with teachers who can teach a combination of science subjects (n=109). Other science teachers will be needed for life science (n=38), earth science (n=27), physical science (n=34), general science (n=39), and other science subjects (n=2).

Most of the superintendents anticipated some to much difficulty in hiring science teachers at the middle school/junior high level. Over half (58%) thought that they would have much to a great deal of difficulty in hiring teachers to teach a combination of science subjects, with an additional 40% indicating some difficulty in hiring a combination of science subjects.

Supply and Demand for Elementary Teachers

At the elementary level, superintendents reported that they anticipate filling 1559 teaching positions within the next five years. They anticipate little difficulty in filling positions at the elementary level, with 73% indicating that

they anticipate little or no difficulty. Twenty-five percent reported that they expect some difficulty, while only two percent indicated that they expect much difficulty. No superintendents thought they would have a great deal of difficulty in filling elementary teaching positions.

Reasons for Anticipated Vacancies

The superintendents also were asked to indicate reasons for anticipated vacancies in high school and middle school/junior high mathematics and science and at the elementary level. They considered reasons such as positions added because of increased student population, positions added because of an increased number of course offerings, teachers obtaining a non-teaching position within the district or in another district, teachers obtaining another teaching position outside of the district, teachers leaving teaching for another career, teacher retirement, or other reasons. The results are presented in Table 51.

Over half of the positions in high school mathematics are expected to be open because of teacher retirements (51%). An additional 23% of the positions will be available because teachers will obtain another teaching position outside of the district. All other reasons were each cited less than 8% of the time. Almost two-thirds of the superintendents responding to this question noted teacher retirement as the primary reason for vacancies in high school mathematics positions.

There is a similar pattern for vacancies in high school science positions, with 54% of the positions expected to be vacated through teacher retirements and 22% through teachers switching to a position in another district. Again, over two-thirds of the superintendents cited teacher retirement as a primary reason for the vacancies.

Table 51. Reasons for Vacant Positions--High School Mathematics, High School Science, Middle School/Junior High Mathematics, Middle School/Junior High Science, and Elementary Teachers

	High School Mathematics			*High School Science*			*Middle School/Junior High Mathematics*			*Middle School/Junior High Science*			*Elementary (K-6)*		
	N Positions	*% total positions* (N=423)	*% superintendents* (N=197)	*N Positions*	*% total positions* (N=394)	*% superintendents* (N=199)	*N positions*	*% total positions* (N=207)	*% superintendents* (N=121)	*N positions*	*% total positions* (N=251)	*% superintendents* (N=136)	*N positions*	*% total positions* (N=1773)	*% superintendents* (N=235)
Position(s) added because of increased student population	27	64	6.6	23	5.8	5.0	15	7.2	6.6	15	6.0	5.9	156	8.8	15.3
Position(s) added because of increased number of course offerings	15	3.5	5.1	19	4.8	6.5	1	0.5	0.8	1	0.4	0.7	4	0.2	1.7
Teacher(s) obtaining a non-teaching position within the district or in another district	16	3.8	6.3	6	1.5	2.5	9	4.3	7.4	7	2.8	5.1	45	2.5	7.7
Teacher(s) obtaining another teaching position outside of the district	98	23.2	36.0	85	21.6	21.7	48	23.2	36.4	44	17.7	30.1	305	17.2	34.0
Teacher(s) leaving teaching for another career	34	8.0	11.2	30	7.6	10.6	18	8.7	13.2	21	8.4	13.2	167	9.4	11.9
Teacher retirement	214	50.6	65.0	213	54.1	68.3	108	52.2	54.5	126	50.6	58.8	1008	56.9	82.6
Other	6	1.4	4.6	4	1.0	1.5	1	0.5	0.8	24	9.6	3.7	53	3.0	3.8
Don't know	13	3.1	4.6	14	3.6	4.0	7	3.4	5.0	13	5.2	4.4	35	2.0	3.4

This pattern also holds for middle school/junior high mathematics and science, where over half of the vacancies are likely to be caused by teacher retirement and an additional one-fourth by teachers obtaining positions in other districts.

At the elementary level, the majority of superintendents (83%) mentioned teacher retirement as a reason for their anticipated vacancies. They reported that 57% of the vacancies at the elementary level would be due to this reason. They also expected about 17% of the vacancies to be due to teachers obtaining another teaching position outside of their district.

Overall, one of ten superintendents reported that they expected teachers in their districts to leave teaching for another career, resulting in approximately 8% of the vacancies in mathematics and science across the grade levels. About 9% of vacant elementary positions were attributed to additional positions being added due to increased student population. Few vacant positions were attributed to positions being added because of an increased number of course offerings or teachers obtaining non-teaching positions within the district or in another district.

Teachers Teaching Outside Their Areas of Endorsement

For the most part, teachers were teaching within their areas of endorsement. Seventy-nine percent of the superintendents (n=240) reported that all of the teachers within their districts were teaching in their areas of endorsement. However, 31 superintendents (10%) indicated that teachers in their districts were teaching outside of their areas of endorsement. Twenty-four superintendents reported that one teacher in the district was teaching outside of his/her area of endorsement, and four reported two teachers. One superintendent indicated that three teachers were teaching outside their areas of endorsement, another indicated five teachers, and another superintendent reported 25 teachers teaching outside their areas of endorsement.

Curriculum Reform and Its Effect on Hiring Practices

Superintendents were also asked in an open-ended question to describe how recent curriculum reform movements in mathematics and science have affected hiring practices in their districts. Ninety-four superintendents (31%) answered this question, providing 96 responses.

Of those responding superintendents, about one-fourth (n=22) indicated that recent curriculum reform movements, such as those recommended by the National Council of Teachers of Mathematics (NCTM), the National Science Education Standards (NSES), and the American Association for the Advancement of Science (AAAS), had impacted the interviewing process in hiring new teachers. These superintendents wrote that they were looking for knowledge of the standards and experience with standards, benchmarks, curriculum writing, and assessment. They note that they have interview questions that directly relate to curriculum reform. One superintendent wrote that *we look for people who know the standards, believe in them, and are willing to be held accountable for student learning*.

Other superintendents (n=10) noted that the current reform movements had impacted curriculum revisions. One wrote that *these standards in math/science drive all curriculum writing and hiring*. Another wrote, "*We are continuing to upgrade our curriculum to meet the standards these reform movements have brought to our school*."

Other comments made by the superintendents focused on the difficulty of finding qualified applicants, writing that *it used to be much easier to hire science teachers when most science teachers had general endorsements that enabled them to teach more science areas* and that *many applicants, particularly for elementary, have no experience or knowledge of curriculum reform movements*. One superintendent commented that *teachers are considering leaving the profession due to restrictive policies and excessive compliance documentation*.

Of the remaining superintendents who responded, about half (47%) indicated the reform movements have had little or no effect on their hiring practices. An additional 10% reported that they had not hired new mathematics or science teachers recently. One superintendent summed it up with, *We hire the best people we can. Our hiring practices haven't changed*.

Comparison to 1992 Study of Teacher Supply and Demand

These questions were asked of superintendents in 1992 at the time of the first study. Unfortunately, it is not useful to directly compare the actual number of teachers needed as reported in the 2002 study with those reported in the 1992 study. In 1992, only one-third of the superintendents participated in the study, while the majority of superintendents participated in 2002. Because of this difference, comparing numbers of teachers needed is not appropriate.

However, several patterns in comparing the two studies are evident. Most of the teachers needed at both times were those who could teach a combination of mathematics or science subject areas. In high school mathematics, in 1992, superintendents generally anticipated some difficulty in hiring, especially for teachers of calculus. In 2002, they anticipate difficulty in hiring in most mathematics subjects. A similar pattern is true for high school science. Physics remains as the science subject for which superintendents particularly see the most difficulty in hiring.

For the middle school/junior high level, superintendents in 2002 expect more difficulty in hiring than they did in 1992. Generally mean ratings are approximately one-half to one point higher, indicating that in 1992, they anticipated some difficulty; in 2002, they are more likely to anticipate much difficulty. There was some change in anticipated difficulty for hiring elementary teachers as well. In 1992, superintendents expected no difficulty; in 2002, they expect a little difficulty, as seen in an increase in the mean from 1.42 to 2.00.

Reasons for the vacancies have remained consistent over the ten years—teacher retirements and teachers obtaining another teaching position outside the district. Adding positions due to increased student population is not as important in explaining vacancies as it was in 1992.

Finally, the impact of curriculum reforms on hiring practices seems to be the same as it was in 1992. At that time, superintendents wrote that they were revising their interviewing and screening processes to incorporate questions about reform, hiring teachers with experience and knowledge of the standards, and changing their curricula to reflect the standards. As in 2002, many superintendents in 1992 indicated that their hiring practices did not change due to the reform efforts.

Partnerships

The Iowa Department of Education, the AEAs, and the higher education institutions in the state are key partners with local school districts in enhancing mathematics and science education. This section focuses on several of the current strategies used to address state-wide initiatives, including the roles that the universities and the AEAs play in providing inservice to mathematics and science teaches, the role of the Iowa Mathematics-Science Coalition, the benefits of collaborative efforts (such as the RAMS conference and the Governor's Conference on Mathematics and Science Reform) among the education partners, and willingness to take leadership roles in seeking grant opportunities.

The Role of Higher Education Institutions and AEAs in Providing Inservice

Higher education institutions and the AEAs are key partners with local school districts. All groups were asked to determine the importance of the roles that colleges and universities and the AEAs have in providing inservice

programs in mathematics and science for teachers. Responses are detailed in Tables 52 and 53.

Teachers rated the role of higher education institutions as important (Table 52). Approximately 70% of all teachers felt that the college or university role was important or very important. They had slightly higher ratings for the role of the AEAs, with over 80% giving ratings of important or very important.

Superintendents, AEA coordinators, and higher education faculty also rated the role of AEAs and higher education institutions as important (Table 53). Superintendents and AEA coordinators saw the role of colleges and universities as more important than the higher education faculty did, with mean ratings of 3.77 (on a four-point scale) by AEA coordinators and 3.35 by superintendents. With the exception of the superintendents, the role of AEAs was rated as important or very important by 70% or more of the respondents. Over half of the superintendents rated the AEA role as not important at all or somewhat important.

Because the scale for the questions asked of the teachers was not identical to the scale of the questions asked of the other three groups, the teacher mean scores and standard deviations were converted using a multiplicative constant of 4/5ths. With the conversion, the mean scores are comparable across groups. See Table 54 for the comparable scores.

In general, the role of the higher education institutions is seen to be important by all groups, particularly by AEA coordinators and superintendents. Teachers rate the importance of the role of the AEAs in providing inservice to mathematics and science teachers higher than do superintendents, AEA coordinators, and college and university mathematics faculty.

In related questions, 94% of superintendents reported that they would participate in an AEA or LEA Consortium if given the opportunity (no table provided). Over half of the AEA coordinators (58%) indicated that they had

Table 52. Importance of the Role of Higher Education and AEAs in Providing Inservice Programs in Mathematics and Science for Teachers--Responses by Teachers

	Very unimportant	*Unimportant*	*Neutral*	*Important*	*Very important*	*Mean*	*S.D.*	*N of valid responses*	*N of no opinion*
How important is the role of higher education institutions in providing inservice programs in mathematics and science for teachers?									
All teachers	2.2%	5.6%	21.7%	49.3%	21.2%	3.82	0.90	736	18
Elementary teachers	3.5%	3.9%	22.1%	46.1%	24.4%	3.84	0.96	258	9
Mathematics teachers	1.6%	8.0%	22.1%	51.4%	16.9%	3.74	0.89	249	7
Science teachers	1.3%	4.8%	21.0%	50.7%	22.3%	3.88	0.86	229	2
How important is the role of the AEAs in providing inservice programs in mathematics and science for teachers?									
All teachers	2.9%	3.2%	12.0%	41.3%	40.5%	4.13	0.95	748	7
Elementary teachers	1.1%	1.9%	11.4%	31.8%	53.8%	4.35	0.84	264	3
Mathematics teachers	3.1%	4.3%	13.4%	42.1%	37.0%	4.06	0.98	254	2
Science teachers	4.8%	3.5%	11.3%	51.3%	29.1%	3.97	0.99	230	2

Rating scale: 1=very unimportant, 2=unimportant, 3=neutral, 4=important, 5=very important

Table 53. Importance of the Role of Higher Education and AEAs in Providing Inservice Programs in Mathematics and Science for Teachers--Responses by Superintendents, AEA Coordinators, and Higher Education Faculty

	Not important at all	*Somewhat important*	*Important*	*Very important*	*Mean*	*S.D.*	*N*
How important is the role of higher education institutions in providing inservice programs in mathematics and science for teachers?							
Superintendents	1.7%	11.0%	38.0%	49.3%	3.35	0.74	292
AEA coordinators	0.0%	0.0%	23.1%	76.9%	3.77	0.43	26
All higher education respondents	12.2%	24.4%	26.8%	36.6%	2.88	1.05	41
Higher education mathematics faculty	10.0%	35.0%	20.0%	35.0%	2.80	1.06	20
Higher education science faculty	0.0%	35.0%	35.0%	30.0%	2.95	1.10	20
How important is the role of the AEAs in providing inservice programs in mathematics and science for teachers?							
Superintendents	12.8%	38.6%	41.0%	7.6%	2.43	0.81	290
AEA coordinators	3.8%	26.9%	38.5%	30.8%	2.96	0.87	26
All higher education respondents	4.8%	26.2%	31.0%	38.1%	3.02	0.92	42
Higher education mathematics faculty	15.0%	15.0%	30.0%	40.0%	2.95	0.83	20
Higher education science faculty	9.5%	14.3%	28.6%	47.6%	3.14	1.01	21

Rating scale: 1=not important at all, 2=somewhat important, 3=important, 4=very important

Table 54. Comparative Mean Scores and Standard Deviations for All Respondents for the Importance of the Roles of Higher Education and AEAs

	Mean	*S.D.*
Role of Higher Education		
Teachers	3.06	0.72
Elementary teachers	3.07	0.77
Mathematics teachers	2.99	0.71
Science teachers	3.10	0.69
Superintendents	3.35	0.74
AEA mathematics and science coordinators	3.77	0.43
Higher education faculty	2.88	1.05
Higher education mathematics faculty	2.80	1.06
Higher education science faculty	2.95	1.10
Role of AEAs		
Teachers	3.30	0.76
Elementary teachers	3.48	0.67
Mathematics teachers	3.25	0.78
Science teachers	3.15	0.79
Superintendents	2.43	0.81
AEA mathematics and science coordinators	2.96	0.87
Higher education faculty	3.02	0.92
Higher education mathematics faculty	2.95	0.83
Higher education science faculty	3.14	1.01

Rating scale: 1=very unimportant, 2=unimportant, 3=important, 4= very important

plans to form a math/science consortium using new Title II funding from the districts (no table provided).

The Role of the Iowa Mathematics-Science Coalition

The Iowa Mathematics-Science Coalition (IMSC) was formed to bring leadership from the mathematics and science community together to work toward improving mathematics and science education in the state. The Coalition Board is made up of educators, business, and policy makers. The IMCS, working closely with the Iowa Department of Education, sponsors major state conferences for science and mathematics educators and provides general oversight of science and mathematics initiatives in the state.

In order to understand what teachers, superintendents, and AEA coordinators thought the role of the IMSC should be, they responded to an open-ended question. Overall, these groups had similar opinions that the primary role of the Coalition should be that of serving as a clearinghouse of information and providing inservice to mathematics and science teachers. Also seen as key roles were leadership in building capacity for reform and developing and supporting standards and assessment. Many of their suggestions seem to indicate that they thought the IMSC should provide more than general oversight of mathematics and science initiatives in the state.

Teachers, superintendents, and AEA coordinators agreed that the IMSC should *provide support in the form of inservices, dissemination of information . . . to schools and classroom teachers on current practices and strategies in math and science* (comment by teacher). Inservice topics mentioned included legislation and its impact (particularly No Child Left Behind (NCLB)); state and national standards for mathematics and science; and teaching strategies, techniques, and materials. They see IMSC as providing opportunities for sharing and networking through inservices and workshops.

Further, all three groups believed that IMSC's role should be one of leadership. They expected IMSC to lobby for legislation that provides funding for education, work to reduce reporting requirements and paperwork for teachers and districts, and encourage entry into and retention in teaching mathematics and science. Teachers thought it was important that IMSC work with teacher education programs to provide information and materials related to reforms and the implications of legislation such as NCLB so that new teachers are prepared to implement the standards. They also see the IMSC as an organization that can participate in building capacity for understanding and encouraging the state and school districts to recognize the importance of more math and science education in K-12, overseeing the overall implementation of reforms, fostering collaboration, encouraging adequate pay for teachers, and

working toward common goals. Several respondents in the teacher and superintendent groups suggested that the IMSC play a role in seeking the repeal of the NCLB.

A third area mentioned was that of developing standards and assessments in mathematics and science. Many superintendents who wrote comments about standards and assessments suggested that IMSC assist in establishing standards, benchmarks, and corresponding assessments that are valid and consistent for all schools. Some teachers also mentioned developing state-wide standards for mathematics and science, and several wanted the IMSC to support local efforts to align standards and benchmarks with assessments. AEA coordinators did not mention this as a role of the IMSC.

Finally, it was evident that some of the teachers, superintendents, and AEA coordinators were not familiar with the IMSC and its activities. Those not familiar with the IMSC were interested in getting more information about it.

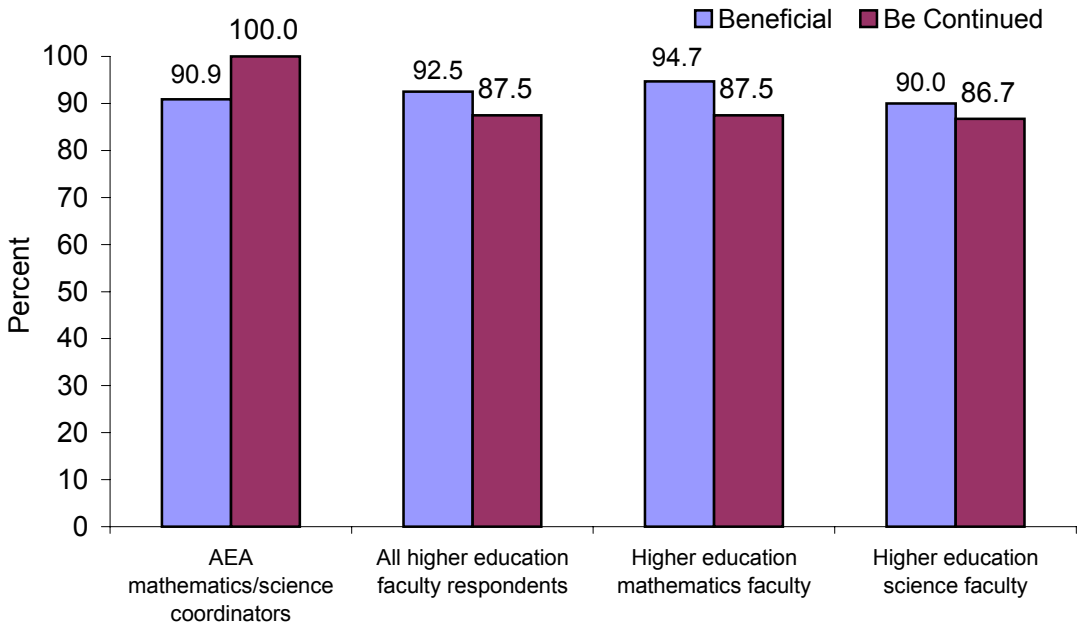
Benefits of Collaboration

The Regents Academy for Mathematics and Science (RAMS) brings together higher education faculty (from private colleges, community colleges, and universities) with Mathematics and Science Coordinators from the AEAs, along with school district teachers and administrators to discuss and form mathematics and science partnerships to further science and math education in the state. The RAMS annual conference is coordinated by the Iowa Mathematics-Science Coalition.

AEA coordinators and higher education faculty reported that they consider a collaboration like RAMS to be beneficial (Figure 19), with over 90% in each group indicating yes. All of the AEA coordinators thought it should be continued, as did over 85% of the higher education respondents.

Additionally, they offered the following thoughts about future academies. AEA coordinators were interested establishing collaborative goal(s) with

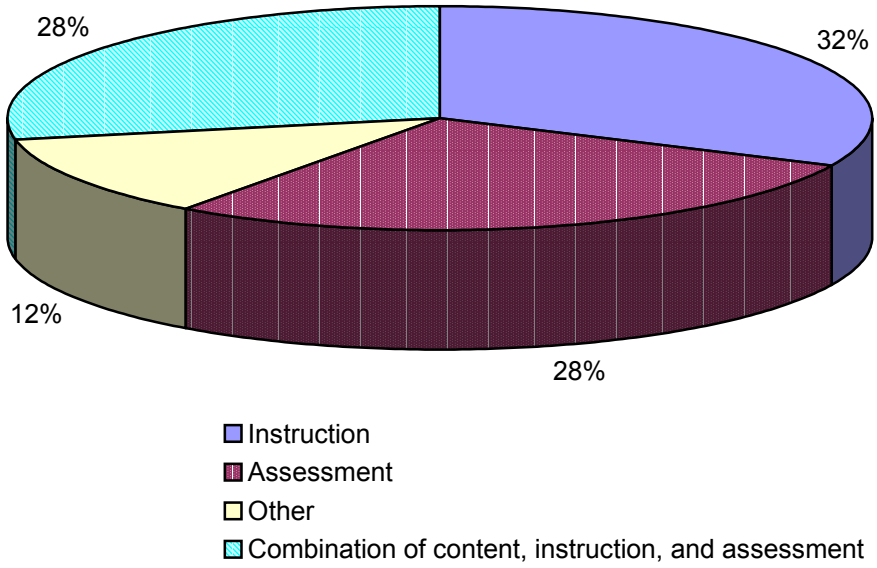
Figure 19. Percentage of Respondents Who Believe that a Collaboration of Universities, Private and Community Colleges, AEAs, and the Department of Education is Beneficial



appropriate strategies and monitoring to carry out to the districts. They advocated using *proven models,* such as Every Student Counts, and research-based strategies that *help students learn mathematics [and science], technology integration, and how to motivate low achieving students*. In particular, they suggested ongoing, sustained professional development addressing topics such as assessment, standards and benchmarks, and curriculum development and mapping. One AEA coordinator recommended *professional inservice using workshop learning and workshop implementation with modeling/coaching assistance, learning by "doing" mathematics, and science using inquiry-based learning strategies*. Higher education faculty listed a variety of topics, including No Child Left Behind, environmental education integration, content requirements, licensure process, assessment, TIMSS, working with parents, state standards, education partnerships, quality teaching, and obtaining grants. They agreed with the AEA coordinators that short-term inservice is inadequate and that strategies that emphasize collaboration would be beneficial.

Another opportunity for partnering is the Governor's Conference for Mathematics and Science Reform. AEA mathematics and science coordinators were also asked if they would like to see the Governor's Conference for Mathematics and Science Reform to be continued annually. Most (83%) indicated that they would. Their suggestions for the emphasis at the next conference were varied, with about one-third (32%) wanting the emphasis to be on instruction, 28% on assessment, and 28% on a combination of content, instruction, and assessment (Figure 20). Three AEA coordinators suggested that other topics be offered, with one coordinator indicating technology integration in mathematics and science as a possible topic.

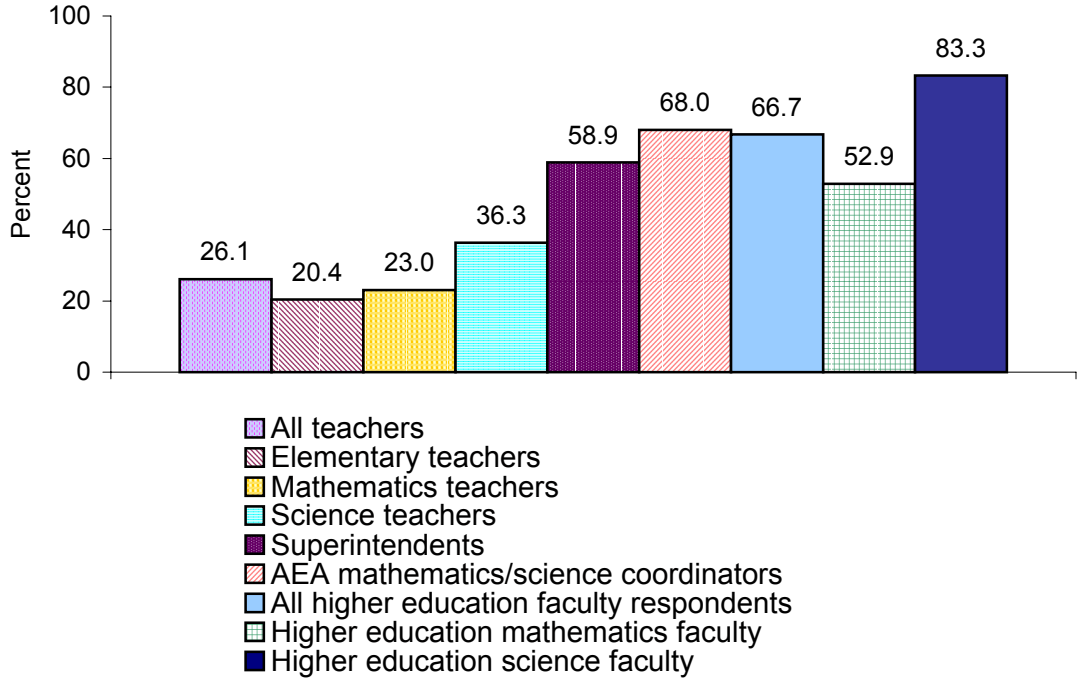
Figure 20. Emphasis for the Next Governor's Conference on Mathematics and Science Reform



Leadership in Seeking Grant Opportunities

A high percentage of the key educational partners were willing to take leadership roles in seeking grant opportunities in mathematics and science education (Figure 21). As expected, superintendents, AEA coordinators, and

Figure 21. Percentage of Respondents Willing to Take a Leadership Role in Seeking Grant Opportunities in Mathematics and Science Education



higher education faculty were most willing. Specifically, 83% of the higher education science faculty, 68% of the AEA coordinators, and 59% of the superintendents expressed a willingness to participate. About one-fourth of the teachers, overall, are willing to take on this leadership opportunity, with science teachers most interested (36%).

National Initiative—No Child Left Behind

A recent national initiative, the No Child Left Behind (NCLB) Act, is already having a widespread impact on mathematics and science education in Iowa. The intent of the NCLB legislation is to close achievement gaps between students who are of different genders, belong to minority groups, have disabilities, or who are economically disadvantaged or have limited English proficiency. To accomplish this, NCLB addresses four principles—accountability

for students' academic achievement, local control of federal education dollars, parental involvement, and the implementation of scientifically proved programs and teaching methods.

The law aims to have all students performing at proficient levels in mathematics and reading by 2014, with educators playing an important role in implementing this reform. Beginning with the 2002-03 school year, teachers and school districts will start setting standards for core subjects, administering annual tests, and reporting on student achievement to parents and policymakers.

All of the groups surveyed were asked to indicate their overall understanding of the NCLB legislation and whether they have an adequate understanding of the law's implication for mathematics and science education. Approximately 45% of elementary and secondary mathematics teachers, superintendents, and AEA mathematics and science coordinators felt that they had an adequate understanding of the law, with 37% of the secondary science teachers responding that they had an adequate understanding (Figure 22). More than half of the higher education faculty in both mathematics (55%) and science (59%) indicated an adequate understanding.

However, fewer teachers indicated that they understood the law's implications for mathematics and science education (32% for all teachers combined, for example) (Figure 23). Slightly more, 40% of the superintendents, 38% of the AEA mathematics and science coordinators, 45% of the higher education mathematics faculty, and 64% of the higher education science faculty, reported adequate understanding of the implications for mathematics and science education.

Comparison by District Size

In 2002, Iowa had 371 public school districts. During the 2001-2002 school year, there were 29 districts in Iowa with fewer than 250 students and 50 districts

Figure 22. Percentage of Respondents Who Have an Adequate Understanding of the "No Child Left Behind" Legislation

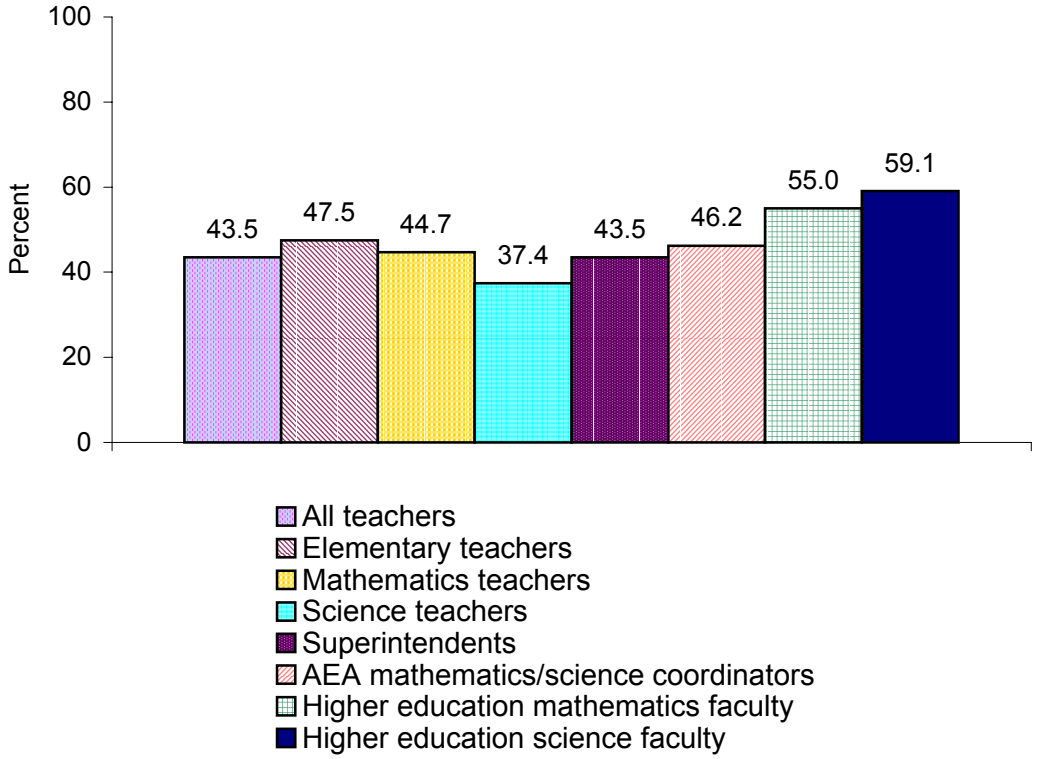
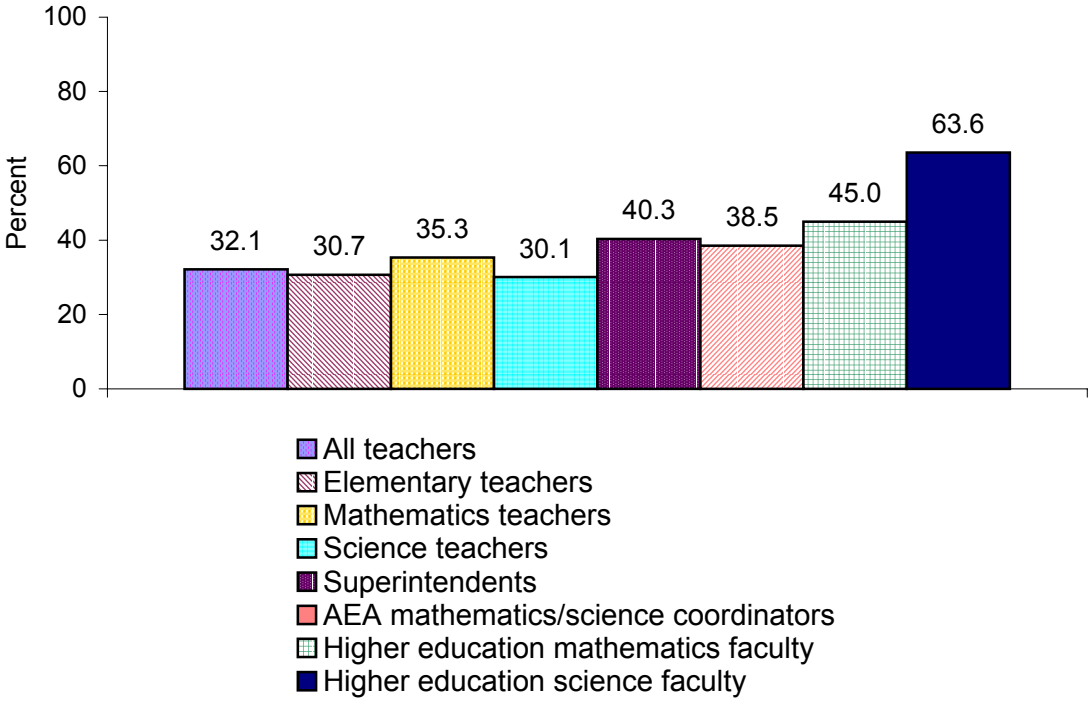


Figure 23. Percentage of Respondents Who Have an Adequate Understanding of the Implications of the "No Child Left Behind" Legislation for Mathematics and Science Education



with 250-399 students. Most of the districts (69%) have fewer than 1000 students, serving 28% of the total number of K-12 students in Iowa. Twenty-two percent have student enrollments of 1000-2499 and 7% have 2500-7499 students. Nine districts (2% of the districts) alone provide educational services to 27% of Iowa's K-12 students, over 130,000 students. The number of public school students and districts are presented by district size in Table 55.

Table 55. Distribution of Iowa Public School Districts and Students by District Size--2001-2002

	Districts		*Students*	
District Size	*N*	*Percent*	*N*	*Percent*
< 1000	256	69.1%	137,046	28.0%
1,000 - 2,499	81	21.8%	121,111	24.8%
2,500 - 7,499	25	6.7%	98,953	20.2%
> 7,500	9	2.4%	132,213	27.0%
Total	371	-	489,523	-

Source: Iowa Department of Education, Division of Financial and Information Services, Certified Enrollment Files.

School districts of different sizes are sometimes thought to have dissimilar problems. For this survey, data provided by superintendents and teachers were disaggregated by district size to look for differences in selected areas.

For the superintendent survey, this analysis examined their anticipated difficulties in hiring new teaching staff in a variety of mathematics and science subjects at the elementary, junior high/middle school, and high school levels; their ratings of the importance of the roles played by the AEAs and Iowa's colleges and universities; questions related to environmental education; and the percentage of their new Title II allocation devoted to teacher professional development in mathematics and science.

The teacher survey also provided data that were used to compare responses for selected questions. These questions included their ratings of the importance of the roles played by the AEAs and higher education institutions, adequacy of preparation and importance of professional development opportunities, use of the ICN for professional development and instructional activities, effectiveness of demonstration classrooms in helping teachers learn to incorporate reforms in their classrooms, what kinds of reforms they have incorporated, and the amount of inservice training on the reforms. Additionally, questions answered by mathematics and science teachers about curriculum revisions, addressing mathematics and science topics, and preparation to teach science subjects were compared by district size. One way analysis of variance (ANOVA) and chi-square statistics were used to test the differences for each group.

Superintendent responses were representative of the population when classified by district size. Seventy-two percent of the responding superintendents led districts with student enrollments of less than 1000 (Table 56). Twenty-one percent were from districts with student enrollment of 1000 to 2499, and 5% were from districts with 2500 to 7499 students. Two percent of the superintendents represented the largest districts where more than 7500 students are enrolled.

A chi-square analysis revealed that teachers in the largest districts were underrepresented, while teachers in the smallest districts (less than 1000 students) were slightly overrepresented (Table 56). Teacher responses in the other two size categories were representative of the population.

Comparison by District Size—Superintendent Responses

The analysis of the data from superintendents showed no differences by size of district on any of the selected variables. Superintendents in smaller districts expected about the same amount of difficulty in hiring mathematics and

Table 56. Number and Percentage of Superintendent and Teacher Respondents

	Superintendents			Teachers		
District Size	*N*	*Percent*	*Population Percent*	*N*	*Percent*	*Population Percent*
< 1000	218	72.2%	69.1%	234	30.8%	28.0%
1,000 - 2,499	63	20.9%	21.8%	204	26.8%	24.8%
2,500 - 7,499	14	4.6%	6.7%	148	19.5%	20.2%
> 7,500	7	2.3%	2.4%	174	22.9%	27.0%

Population Percent Source: Iowa Department of Education, Division of Financial and Information Services, Certified Enrollment Files.

science teachers in all subject areas and all levels as did those in the larger districts. There were also no differences in the results by district size in rating the importance of the roles of the AEAs and higher education institutions, whether environmental education was incorporated into the curriculum, the importance of environmental education in the curriculum, and the percentage of Title II funds intended to be allocated for professional development opportunities in mathematics and science[6].

Comparison by District Size—Teacher Responses

The analysis of the data from teachers on selected questions showed a few differences by size of district. For several variables, differences in district size were evident in the adequacy of preparation and importance of professional development opportunities for mathematics and science teachers. Teachers in larger districts rated planning and delivering instruction, selecting and organizing materials, and meeting the needs of underrepresented groups in mathematics and science as significantly more important than did teachers in

[6] No tables are included for the non-significant comparisons.

districts with fewer than 1000 students (Table 57). Teachers in districts with fewer than 1000 students reported that they were more adequately prepared in working with students with learning problems than were teachers in districts with 1000 to 2499 students. Finally, teachers in districts with 2500 to 7499 students reported that they were more adequately prepared in coordinating curriculum standards and benchmarks with assessment than were teachers in districts with 1000 to 2499 students; they also reported that they place a higher level of importance on professional development opportunities in this area.

One other difference was evident in adequacy of preparation for science teachers. Teachers in districts with student enrollments of 2500 to 7499 believed they were more prepared to improve reading and writing skills through science teaching than were teachers in districts with enrollments of 1000 to 2499. Additionally, teachers in smaller districts are using the ICN more than teachers in larger districts, both for professional development activities and to provide instructional activities for their students. (See Table 58.)

There were also differences by district size for questions related to curriculum revision and reform. Half or more of the teachers indicated that the latest revisions to district mathematics curricula had been made within the last two years in districts with enrollments of less than 2500 and 7500 or more (Table 59). Districts with enrollments of 2500 to 7499 were more likely to have revised mathematics curricula three or more years ago. Science curriculum revisions were most often made within the past two years for districts of all sizes. In the largest districts with enrollments of 7500 or more, however, 29% of the teachers reported curriculum revisions occurring five or more years ago.

Approximately one-fourth to one-third of the teachers indicated that curriculum revision in mathematics was currently underway (Table 60). A higher percentage than expected of teachers in the smallest districts reported that curriculum revisions in mathematics would likely occur in the next one to two years. Thirty-five percent of the teachers in the largest districts (7500 or more

Table 57. Adequacy of Preparation and Importance of Professional Development Opportunities--Comparison by District Size--Significant Results Only

	Mean	*S.D.*	*N*	*F*	*Significance*	*Multiple comparison of group differences*
Importance of planning and delivering instruction						
< 1000	4.41	0.70	230	3.32	0.02	4 vs 1
1,000 - 2,499	4.46	0.71	201			
2,500 - 7,499	4.59	0.71	142			
> 7,500	4.59	0.70	167			
Importance of selecting and organizing materials						
< 1000	4.29	0.72	230	3.37	0.02	3 vs 1
1,000 - 2,499	4.36	0.67	149			
2,500 - 7,499	4.49	0.73	143			
> 7,500	4.47	0.72	168			
Importance of meeting the needs of underrepresented groups in mathematics and science						
< 1000	3.80	0.88	224	4.17	0.01	3, 4 vs 1
1,000 - 2,499	3.92	0.82	198			
2,500 - 7,499	4.08	0.90	145			
> 7,500	4.06	0.85	162			
Adequacy of preparation in working with students with learning problems						
< 1000	3.74	0.95	231	3.32	0.02	1 vs 2
1,000 - 2,499	3.46	1.01	198			
2,500 - 7,499	3.57	1.01	145			
> 7,500	3.50	1.04	165			

Adequacy rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

Importance rating scale: 1=very unimportant, 2=unimportant, 3=neutral, 4=important, 5=very important

*Mean importance ratings are significantly higher than mean adequacy ratings.

Group differences determined by Tukey post hoc test multiple comparison test (1=<1000, 2=1,000-2,499, 3=2,500-7,499, 4=>7,500).

Table 57. (continued)

	Mean	*S.D.*	*N*	*F*	*Significance*	*Multiple comparisons of group differences*
Adequacy of preparation in coordinating curriculum standards and benchmarks with assessment						
< 1000	3.72	0.96	232	2.81	0.04	2 vs 3
1,000 - 2,499	3.65	0.95	202			
2,500 - 7,499	3.92	0.91	145			
> 7,500	3.82	0.89	168			
Importance of preparation in coordinating curriculum standards and benchmarks with assessment						
< 1000	3.91	1.01	232	4.46	0.03	2 vs 3, 4
1,000 - 2,499	3.85	1.00	203			
2,500 - 7,499	4.17	0.99	144			
> 7,500	4.13	0.96	168			
Adequacy of preparation in improving reading and writing skills through science teaching						
< 1000	3.16	1.03	154	3.05	0.03	2 vs 3
1,000 - 2,499	3.02	1.10	128			
2,500 - 7,499	3.44	1.06	87			
> 7,500	3.29	0.98	106			

Table 58. Teacher Use of ICN--Comparison by District Size

	Mean	*S.D.*	*N*	*F*	*Significance*	*Multiple comparisons of group differences*
Use of ICN for professional development activities						
< 1000	1.30	0.46	233	4.88	0.00	1, 2 vs 4
1,000 - 2,499	1.34	0.48	201			
2,500 - 7,499	1.40	0.49	147			
> 7,500	1.47	0.50	169			
Use of ICN to provide instructional activities for students						
< 1000	1.62	0.49	233	13.68	0.00	1 vs 2, 3, 4
1,000 - 2,499	1.78	0.42	202			
2,500 - 7,499	1.84	0.36	147			
> 7,500	1.86	0.35	169			

Rating scale: 1=yes, 2=no

Group differences determined by Tukey post hoc test multiple comparison test (1=<1000, 2=1,000-2,499, 3=2,500-7,499, 4=>7,500)

Table 59. Curriculum Revisions and Reforms--Latest Revision--Comparison by District Size--Significant Results Only

	Within last year	*1-2 years ago*	*3-4 years ago*	*5 or more years*	X^2	*Significance*
Latest revision of mathematics curriculum						
< 1000	22.4%	34.7%	31.3%	11.6%	19.71	0.02
1,000 - 2,499	20.7%	27.2%	24.3%	19.9%		
2,500 - 7,499	16.2%	25.3%	32.3%	26.3%		
> 7,500	30.9%	33.0%	20.6%	15.5%		
Latest revision of science curriculum						
< 1000	30.5%	28.2%	28.2%	13.0%	19.44	0.02
1,000 - 2,499	19.5%	37.2%	28.3%	15.0%		
2,500 - 7,499	25.3%	36.7%	17.7%	20.3%		
> 7,500	22.1%	33.7%	15.1%	29.1%		

Table 60. Curriculum Revisions and Reforms--Expect Next Curriculum Revision--Comparison by District Size--Significant Results Only

	Currently under revision	*1-2 years*	*3-4 years*	*5 years*	X^2	*Significance*
Expect the next revision of mathematics curriculum						
< 1000	24.6%	32.2%	25.4%	17.8%	20.74	0.01
1,000 - 2,499	23.8%	21.9%	29.5%	24.8%		
2,500 - 7,499	26.6%	32.9%	22.8%	17.7%		
> 7,500	33.8%	11.3%	19.7%	35.2%		
Expect the next revision of science curriculum						
< 1000	15.8%	38.6%	22.8%	22.8%	22.82	0.01
1,000 - 2,499	32.6%	17.9%	29.5%	20.0%		
2,500 - 7,499	27.9%	14.7%	27.9%	29.4%		
> 7,500	21.6%	29.4%	23.3%	15.7%		

students) expect the next revision in five years. Since 55 to 60% of the teachers reported that recent curriculum revisions had been made in science, it is not surprising that about half indicate that the next revisions are expected in three or more years. About 40% of the teachers in districts with enrollments of less than

1000 expect a science curriculum revision in the next one to two years, while about 30% of teachers in districts with 1000 to 7499 students report that revisions to science curricula are currently underway.

Teachers also had differing opinions about district policies regarding adherence to mathematics and science curriculum by individual teachers (Table 61). Over half of teachers in districts with student enrollment of 2500 or more believed that the curriculum was required in mathematics and about one-third thought it was suggested. In the smaller districts (less than 2500 students), teachers were split, with about half reporting that it was required and other half indicating it was suggested or voluntary. In fact, 13% of the teachers in districts with fewer than 1000 students believed the mathematics curriculum to be voluntary. A similar pattern was evident for science teachers. Over 60% of the teachers in districts with 2500 to 7499 students reported that adhering to their science curriculum was required. Most teachers in districts with fewer than 2500 students and those in districts with 7500 students or more thought the science curriculum was either required or suggested. Over 10% of teachers in the smallest districts and the largest districts viewed their adherence to the science curriculum as voluntary.

No differences in responses by district size were found for the following teacher questions—ratings of the importance of the roles of AEAs and higher education institutions, the effectiveness of demonstration classrooms in helping teachers learn how to incorporate standards-based reform into their classrooms, the kinds of reforms teachers are incorporating in their classrooms, the total amount of inservice training in recent reforms, the extent to which teachers have applied skills and knowledge learned through inservice training, and whether standards for mathematics and science were incorporated into their latest curriculum revisions[7].

[7] No tables are included for the non-significant comparisons.

Table 61. Curriculum Revisions and Reforms--Policy on Adhering to Curriculum--Comparison by District Size--Significant Results Only

	Required	*Suggested*	*Voluntary*	X^2	*Significance*
District policy regarding adherence to math curriculum by individuals					
< 1000	41.5%	45.6%	12.9%	12.86	0.04
1,000 - 2,499	49.0%	42.8%	8.3%		
2,500 - 7,499	61.1%	32.7%	6.2%		
> 7,500	54.9%	36.5%	8.8%		
District policy regarding adherence to science curriculum by individuals					
< 1000	40.9%	47.7%	11.4%	14.07	0.03
1,000 - 2,499	44.4%	48.1%	7.5%		
2,500 - 7,499	63.3%	32.2%	4.4%		
> 7,500	48.6%	41.0%	10.5%		

Comparison of Results—1992, 1995, and 2002

The 2002 Iowa Mathematics and Science Needs is the third in a series of studies examining elementary and secondary curriculum needs and professional development in mathematics and science in Iowa. In 1992, over 600 secondary mathematics and science teachers and elementary teachers participated in a study that (1) compiled information on how mathematics and science curricula were structured, when they were last revised, and familiarity with the new reform efforts in mathematics and science; (2) examined factors and possible strategies related to improving elementary and secondary mathematics and science education in Iowa; and (3) examined needs for professional development for mathematics and science teachers. In 1995, many of these same teachers participated in a follow-up survey to examine changes in teacher knowledge of and attitude about reform efforts, types of reforms in mathematics and science implemented, application of skills and knowledge in K-12 classrooms, and

whether reforms were successfully implemented. [Note: In this section, responses for 1995 demonstration and visiting teachers were not included, only the responses for teachers who had originally responded in 1992.]

To continue to monitor changes in teacher knowledge and attitudes, the 2002 survey contained several of the same questions asked in 1992 and in 1995. This section presents descriptive results for questions that were common in at least two of the three surveys. For some of the questions, data were available for all three surveys. Common questions are addressed for the following topic areas—teacher preparation and licensure, improving mathematics and science, teacher professional development, implementing reforms in K-12 classrooms in Iowa, and use of technology.

Teacher Preparation and Licensure

Teachers' perceptions of the overall preparation of mathematics and science teachers in 1992 were compared with teachers' perceptions in 2002 (Table 62). In most cases, teachers in 2002 rated elementary teachers as slightly better prepared to teach mathematics and science than did teachers ten years earlier. This pattern was also evident for teachers' ratings regarding middle school/junior high and high school teachers. Teachers' preparation to use instructional technology in mathematics and science was rated similarly in 1992 and 2002.

Improving Mathematics and Science

Two questions were asked across surveys in this section. In 1992, 1995, and 2002, teachers rated their adequacy and the importance of factors that could improve mathematics and science. Additionally, a question about possible

Table 62. Comparison of Teachers' Perception of the Overall Preparation of Mathematics and Science Teachers--1992 and 2002

	1992			*2002*		
	Mean	*S.D.*	*N*	*Mean*	*S.D.*	*N*
Elementary teachers in your district are well prepared to teach mathematics.						
All teachers	4.21	1.13	465	4.43	1.13	628
Elementary teachers	4.78	0.98	171	4.87	0.96	261
Mathematics teachers	3.71	1.13	155	3.95	1.20	215
Science teachers	4.08	0.98	139	4.36	0.98	152
Elementary teachers in your district are well prepared to teach science.						
All teachers	3.67	1.13	463	3.99	1.20	591
Elementary teachers	4.03	1.26	169	4.26	1.15	260
Mathematics teachers	3.59	0.84	154	3.98	1.13	141
Science teachers	3.36	1.16	140	3.62	1.23	190
Middle school/junior high teachers in your district are well prepared to teach mathematics.						
All teachers	4.72	1.04	461	4.86	1.08	622
Elementary teachers	4.42	1.02	168	5.06	0.88	185
Mathematics teachers	4.76	1.07	154	4.64	1.24	243
Science teachers	4.6	1.03	139	4.94	1.00	194
Middle school/junior high teachers in your district are well prepared to teach science.						
All teachers	4.68	1.03	459	4.85	1.09	588
Elementary teachers	4.66	1.08	168	4.95	0.98	184
Mathematics teachers	4.48	1.02	152	4.74	1.16	185
Science teachers	4.92	0.96	139	4.86	1.10	219

Rating scale: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree

Note: 1992 5-point rating scale converted to a 6-point scale for comparison.

Table 62. (continued)

	1992			2002		
	Mean	*S.D.*	*N*	*Mean*	*S.D.*	*N*
High school teachers in your district are well prepared to teach mathematics.						
All teachers	5.14	0.92	461	5.27	0.88	629
Elementary teachers	4.79	1.02	168	5.14	0.94	177
Mathematics teachers	5.39	0.68	154	5.35	0.82	249
Science teachers	5.24	0.89	139	5.29	0.88	203
High school teachers in your district are well prepared to teach science.						
All teachers	5.04	0.95	459	5.29	0.81	613
Elementary teachers	4.68	0.89	167	5.16	0.93	177
Mathematics teachers	5.12	0.76	153	5.33	0.73	219
Science teachers	5.36	1.04	139	5.36	0.76	217
Teachers in your district are well prepared to use instructional technology in teaching mathematics and science.						
All teachers	4.13	1.19	466	4.08	1.16	699
Elementary teachers	4.13	1.14	171	4.02	1.17	230
Mathematics teachers	4.07	1.26	155	4.11	1.16	249
Science teachers	4.19	1.18	140	4.13	1.15	220

strategies to improve mathematics and science education was asked in 1992 and in 2002.

Teachers in 1992 and 2002 provided information about the adequacy and importance of selected factors for improving mathematics and science (Table 63). Teachers in 1995 were asked to respond for only a limited number of these factors. This question provided insight into areas of need as determined by lower adequacy and higher importance. (See Figures 4 through 8 for a graphic representation of 2002 results.) Table 64 summarizes areas of need by teacher respondent group for 1992 and 2002. An X indicates an area of need.

In 1992, areas of need for all teachers combined included level of funding for science and mathematics; leadership/assistance from universities; leadership/assistance from the State Department of Education; leadership/assistance from counselors in their buildings or districts; involvement of parents, community members, and business leaders in reform efforts; articulation between levels in mathematics and science; use of multiple assessment measures; and availability of appropriate instructional technology in the classroom for teaching mathematics and science. In most cases, these same areas were classified as areas of need for elementary teachers, secondary mathematics teachers, and secondary science teachers.

In 2002, fewer areas of need were reported. These areas of need for all teachers included level of funding for science and mathematics; leadership/assistance from universities; leadership/assistance from the State Department of Education; and articulation between levels in mathematics and science. Secondary mathematics and science teachers reported communication between educators, parents, community members, and business leaders as an area of need. Elementary teachers also reported two additional areas of need—availability of appropriate instructional technology in the classroom for teaching mathematics and science and teachers' skills to utilize it in mathematics and science.

Table 63. Comparison of Teachers' Opinions about Adequacy and Importance of Factors Related to Improving Mathematics and Science--1992, 1995, and 2002

	Adequacy						*Importance*					
	1992		*1995*		*2002*		*1992*		*1995*		*2002*	
	Mean	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*
A Level of funding for science and mathematics (equipment, facilities, staff)												
All teachers	2.82	458	NA	NA	2.90	740	4.40	463	NA	NA	4.23	738
Elementary teachers	2.89	158			3.13	253	4.52	165			4.25	256
Mathematics teachers	2.80	161			2.88	254	4.31	159			4.16	253
Science teachers	2.76	139			2.67	233	4.37	139			4.28	229
B Leadership/assistance from universities												
All teachers	2.84	439	2.88	288	2.86	676	3.72	445	3.90	293	3.57	693
Elementary teachers	2.83	151			2.87	218	3.85	157			3.59	230
Mathematics teachers	2.77	155			2.75	235	3.68	154			3.49	244
Science teachers	2.93	133			2.97	223	3.60	134			3.65	219
C Leadership/assistance from AEAs												
All teachers	3.46	463	3.55	296	3.50	743	3.97	466	4.19	296	3.93	742
Elementary teachers	3.58	165			3.69	259	4.19	168			4.08	261
Mathematics teachers	3.35	159			3.40	255	3.89	159			3.88	254
Science teachers	3.45	139			3.38	229	3.80	139			3.80	227
D Leadership/assistance from State Department of Education												
All teachers	2.74	426	2.73	290	2.78	674	3.51	446	3.71	293	3.57	707
Elementary teachers	2.86	139			2.88	219	3.70	153			3.65	237
Mathematics teachers	2.60	154			2.69	240	3.41	155			3.53	246
Science teachers	2.77	133			2.78	215	3.41	138			3.53	224
E Leadership/assistance from administrators in your building/district												
All teachers	3.35	469	NA	NA	3.60	750	4.23	466	NA	NA	4.28	749
Elementary teachers	3.44	169			3.76	263	4.38	169			4.37	266
Mathematics teachers	3.37	161			3.48	256	4.22	159			4.21	256
Science teachers	3.21	139			3.54	231	4.05	138			4.26	227

Adequacy rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate
Importance rating scale: 1=very unimportant, 2=unimportant, 3=neutral, 4=important, 5=very important
1995 results available only for all teachers combined, selected items only.

Table 63. (continued)

	Adequacy						Importance					
	1992		1995		2002		1992		1995		2002	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
F Leadership/assistance from teachers in your building/district												
All teachers	3.90	464	3.57	298	4.02	747	4.35	463	4.42	298	4.37	747
Elementary teachers	4.00	167			4.04	264	4.44	168			4.36	264
Mathematics teachers	3.85	160			3.96	257	4.35	159			4.39	257
Science teachers	3.83	137			4.07	226	4.24	136			4.36	226
G Leadership/assistance from curriculum supervisors in your district[a]												
All teachers	2.95	417	NA	NA	3.21	691	3.73	422	NA	NA	3.99	703
Elementary teachers	3.01	133			3.45	243	3.80	139			4.16	249
Mathematics teachers	3.01	153			3.00	230	3.75	153			3.89	237
Science teachers	2.81	131			3.15	218	3.64	130			3.91	217
H Knowledge about reform efforts in mathematics												
All teachers	3.34	415	NA	NA	3.35	629	4.16	429	NA	NA	3.99	654
Elementary teachers	3.53	115			3.25	237	4.33	163			4.13	247
Mathematics teachers	3.45	159			3.43	249	4.25	158			3.95	249
Science teachers	3.13	100			3.38	143	3.78	108			3.82	158
I Knowledge about reform efforts in science												
All teachers	3.19	388	NA	NA	3.33	575	4.15	418	NA	NA	4.01	613
Elementary teachers	3.11	151			3.14	229	4.33	160			4.07	243
Mathematics teachers	3.24	102			3.24	123	3.98	119			3.82	146
Science teachers	3.24	135			3.59	223	4.09	139			4.07	224
J Communication among educators, parents, community members, and business leaders												
All teachers	3.06	462	NA	NA	3.43	738	4.12	462	NA	NA	4.08	742
Elementary teachers	3.22	164			3.56	257	4.18	166			4.21	261
Mathematics teachers	2.89	161			3.32	252	4.11	159			3.98	254
Science teachers	3.08	137			3.41	229	4.07	137			4.05	227

[a] In 1992, this item was worded as leadership/assistance from academic counselors in your building/district.

Table 63. (continued)

	Adequacy						Importance					
	1992		1995		2002		1992		1995		2002	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
K Involvement of parents, community members, and business leaders in reform efforts												
All teachers	2.82	444	NA	NA	3.02	691	3.90	453	NA	NA	3.66	713
Elementary teachers	2.94	156			3.17	229	4.04	165			3.81	246
Mathematics teachers	2.66	155			2.93	245	3.85	154			3.60	247
Science teachers	2.87	133			2.97	217	3.97	134			3.56	220
L Opportunities for teacher inservice activities in mathematics and science												
All teachers	3.31	468	NA	NA	3.13	750	4.39	465	NA	NA	4.19	748
Elementary teachers	3.45	170			3.34	264	4.59	168			4.23	265
Mathematics teachers	3.32	160			2.99	256	4.33	159			4.16	256
Science teachers	3.12	138			3.06	230	4.23	138			4.17	227
M Opportunities for teachers to reflect on own teaching												
All teachers	3.22	459	NA	NA	3.27	750	4.29	448	NA	NA	4.24	748
Elementary teachers	3.28	163			3.33	263	4.44	155			4.29	265
Mathematics teachers	3.19	159			3.22	256	4.19	156			4.16	256
Science teachers	3.17	137			3.24	231	4.24	137			4.26	227
N Opportunities for teachers to share ideas and strategies with peers												
All teachers	3.03	457	NA	NA	3.12	752	4.40	453	NA	NA	4.33	746
Elementary teachers	3.07	163			3.23	264	4.55	159			4.40	264
Mathematics teachers	3.04	159			3.04	256	4.34	157			4.23	256
Science teachers	2.96	135			3.06	232	4.29	137			4.35	226
O Articulation between levels (elementary, middle school/junior high, high school) in mathematics												
All teachers	2.69	430	NA	NA	2.86	665	4.24	433	NA	NA	4.25	699
Elementary teachers	2.64	157			2.95	251	4.25	156			4.15	259
Mathematics teachers	2.59	160			2.70	249	4.30	158			4.31	250
Science teachers	2.88	113			2.97	165	4.15	119			4.32	190

Table 63. (continued)

	Adequacy						Importance					
	1992		1995		2002		1992		1995		2002	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
P Articulation between levels (elementary, middle school/junior high, high school) in science												
All teachers	2.73	389	NA	NA	2.87	589	4.20	413	NA	NA	4.21	638
Elementary teachers	2.59	152			2.91	244	4.21	154			4.13	254
Mathematics teachers	2.79	101			2.86	118	4.13	121			4.20	158
Science teachers	2.84	136			2.83	227	4.26	138			4.30	226
Q Use of multiple assessment measures (e.g., portfolios, authentic assessment, standardized tests, criterion-referenced tests)												
All teachers	2.98	444	NA	NA	3.46	735	3.67	439	NA	NA	3.84	742
Elementary teachers	3.10	154			3.64	258	3.94	152			4.14	264
Mathematics teachers	2.91	157			3.25	251	3.49	153			3.58	252
Science teachers	2.91	133			3.47	226	3.57	134			3.77	226
R Quality of instructional materials in mathematics (textbooks, media, and manipulatives, etc.)												
All teachers	3.62	416	NA	NA	3.69	666	4.38	421	NA	NA	4.37	694
Elementary teachers	3.60	158			3.78	265	4.64	156			4.52	265
Mathematics teachers	3.62	159			3.65	254	4.31	157			4.30	251
Science teachers	3.64	99			3.60	147	4.12	108			4.25	178
S Quality of instructional materials in science (textbooks, media, and manipulatives, etc.)												
All teachers	3.31	385	NA	NA	3.48	611	4.34	400	NA	NA	4.37	651
Elementary teachers	3.12	156			3.37	256	4.56	154			4.44	261
Math teachers	3.36	92			3.68	125	4.08	108			4.24	162
Science teachers	3.50	137			3.50	230	4.30	138			4.39	228
T Teacher awareness of the uses of instructional technology in mathematics and science												
All teachers	3.26	455	NA	NA	3.25	729	4.30	450	NA	NA	4.07	741
Elementary teachers	3.18	109			3.02	250	4.36	155			4.03	258
Mathematics teachers	3.20	159			3.33	254	4.24	157			4.06	255
Science teachers	3.42	136			3.40	225	4.30	138			4.12	228

Table 63. (continued)

	Adequacy						Importance					
	1992		1995		2002		1992		1995		2002	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
U Availability of appropriate instructional technology in the classroom for teaching mathematics and science												
All teachers	2.82	453	NA	NA	3.04	741	4.31	447	NA	NA	4.08	745
Elementary teachers	2.73	159			2.91	255	4.40	154			4.05	262
Mathematics teachers	2.82	158			3.12	255	4.22	155			4.04	255
Science teachers	2.92	136			3.09	231	4.31	138			4.15	228
V Teachers' skills to utilize appropriate instructional technology in mathematics and science												
All teachers	3.18	448	NA	NA	3.16	739	4.28	443	NA	NA	4.11	745
Elementary teachers	3.10	159			2.99	256	4.42	154			4.06	262
Mathematics teachers	3.17	156			3.26	254	4.24	154			4.12	254
Science teachers	3.28	133			3.23	229	4.18	135			4.16	229
W Strategies for encouraging participation by underrepresented groups (females, minorities, disabled) in mathematics and science												
All teachers	3.27	436	NA	NA	3.36	701	3.95	430	NA	NA	3.94	716
Elementary teachers	3.11	150			3.31	238	4.10	148			4.02	251
Mathematics teachers	3.34	157			3.35	240	3.84	154			3.81	241
Science teachers	3.36	129			3.43	223	3.91	128			3.98	224

Table 64. Comparison of Areas of Need in Factors Related to Improving Mathematics and Science--1992 and 2002

	1992				2002			
	All teachers	*Elementary teachers*	*Mathematics teachers*	*Science teachers*	*All teachers*	*Elementary teachers*	*Mathematics teachers*	*Science teachers*
A Level of funding for science and mathematics (equipment, facilities, staff)	X	X	X	X			X	X
B Leadership/assistance from universities	X	X	X	X	X	X	X	X
C Leadership/assistance from AEAs								
D Leadership/assistance from State Department of Education	X	X	X	X	X	X	X	X
E Leadership/assistance from administrators in your building/district								
F Leadership/assistance from teachers in your building/district								
G Leadership/assistance from counselors/curriculum supervisors in your district				X				
H Knowledge about reform efforts in mathematics								
I Knowledge about reform efforts in science								
J Communication among educators, parents, community members, and business leaders			X					
K Involvement of parents, community members, and business leaders in reform efforts	X	X	X	X			X	X
L Opportunities for teacher inservice activities in mathematics and science							X	
M Opportunities for teachers to reflect on own teaching								

X represents an area of need (low adequacy/high importance)

Table 64. (continued)

	1992				2002			
	All teachers	*Elementary teachers*	*Mathematics teachers*	*Science teachers*	*All teachers*	*Elementary teachers*	*Mathematics teachers*	*Science teachers*
N Opportunities for teachers to share ideas and strategies with peers				X				
O Articulation between levels (elementary, middle school/junior high, high school) in mathematics	X	X	X	X	X	X	X	X
P Articulation between levels (elementary, middle school/junior high, high school) in science	X	X	X	X	X	X	X	X
Q Use of multiple assessment measures (e.g., portfolios, authentic assessment, standardized tests, criterion-referenced tests)			X	X				
R Quality of instructional materials in mathematics (textbooks, media, and manipulatives, etc.)								
S Quality of instructional materials in science (textbooks, media, and manipulatives, etc.)								
T Teacher awareness of the uses of instructional technology in mathematics and science								
U Availability of appropriate instructional technology in the classroom for teaching mathematics and science	X	X	X	X		X		
V Teachers' skills to utilize appropriate instructional technology in mathematics and science						X		
W Strategies for encouraging participation by underrepresented groups (females, minorities, disabled) in mathematics and science								

Teachers in 1992 were somewhat more convinced that selected strategies could improve mathematics and science than were the teachers in 2002 (Table 65). For all of the listed strategies, teachers in 1992 gave higher ratings. For both surveys, teachers had the highest level of agreement about the following as possible strategies to improve mathematics and science—establishing or enhancing partnerships with universities and the private sector, increasing instructional time with mathematics and science at the elementary level, requiring elementary teachers to take more mathematics and science at the undergraduate level, and establishing a state clearinghouse to disseminate information on local, state, and national mathematics and science education programs and activities.

Teacher Professional Development

Comparisons of common questions regarding teacher professional development are summarized in this section. Questions addressed adequacy and importance of teacher professional development in specific topic areas, and their needs for training in content knowledge, standards, and other topic areas. Teacher professional development needs were reported as generally met in both 1992 and in 2002 (Table 66). Areas with the higher adequacy ratings in both years were planning and delivering instruction, selecting and organizing materials, understanding and managing behavior problems in the classroom, and content knowledge in both mathematics and science. Teachers in both survey periods agreed that all topics listed were important.

Tables 67 and 68 show that in 1995 teachers agreed that they needed more opportunities for professional development or inservice training in content knowledge and in incorporating standards for both mathematics and science. Fewer teachers in 2002 agreed that they needed more opportunities.

Table 65. Comparison of Teachers' Opinions on Possible Strategies to Improve Mathematics and Science Education--1992 and 2002

	1992			2002		
	Mean	*S.D.*	*N*	*Mean*	*S.D.*	*N*
A State Clearinghouse for the dissemination of information on all local, state, and national science and mathematics education programs and activities is needed in Iowa.						
All teachers	4.38	1.10	466	3.87	1.22	743
Elementary teachers	4.28	1.09	169	3.80	1.19	257
Mathematics teachers	4.44	1.06	159	3.88	1.20	257
Science teachers	4.42	1.16	138	3.95	1.28	229
Partnerships with the private sector are a good way to enhance mathematics and science programs in your school district.						
All teachers	4.74	0.95	467	4.25	1.05	752
Elementary teachers	4.79	0.91	169	4.30	1.09	264
Mathematics teachers	4.63	1.02	160	4.19	1.01	257
Science teachers	4.82	0.89	138	4.26	1.05	231
Partnerships with universities are a good way to enhance mathematics and science programs in your school district.						
All teachers	4.74	0.94	465	4.48	0.97	749
Elementary teachers	4.82	0.97	169	4.62	0.94	263
Mathematics teachers	4.63	0.92	159	4.31	1.00	256
Science teachers	4.76	0.94	137	4.53	0.95	230
Partnerships with the private sector (e.g., donated equipment, resource people) in mathematics and science often exist in your school district.						
All teachers	3.38	1.37	465	2.96	1.29	742
Elementary teachers	3.54	1.38	168	3.13	1.34	259
Mathematics teachers	3.10	1.31	159	2.67	1.21	255
Science teachers	3.53	1.40	138	3.09	1.00	228

Rating scale: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree
Note: 1992 5-point scale converted to 6-point scale for comparison.

Table 65. (continued)

	1992			2002		
	Mean	*S.D.*	*N*	*Mean*	*S.D.*	*N*
Partnerships with the universities (e.g., mentor programs, special projects) in mathematics and science often exist in your school district.						
All teachers	3.17	1.26	465	2.85	1.30	748
Elementary teachers	3.31	1.25	168	2.96	1.37	261
Mathematics teachers	2.95	1.22	159	2.69	1.25	255
Science teachers	3.24	1.27	138	2.91	1.28	232
Increased instructional time in the areas of mathematics and science at the elementary level would improve mathematics and science education in your district.						
All teachers	4.73	1.12	466	4.49	1.15	745
Elementary teachers	4.48	0.97	169	4.05	1.22	264
Mathematics teachers	4.87	1.02	159	4.74	1.05	255
Science teachers	4.87	1.26	138	4.71	1.03	226
Requiring elementary teachers to take more mathematics and science at the undergraduate level would improve math and science education.						
All teachers	4.68	1.19	465	4.32	1.20	748
Elementary teachers	4.32	1.42	168	3.82	1.21	264
Mathematics teachers	4.99	0.94	159	4.50	1.15	256
Science teachers	4.79	1.00	138	4.70	1.02	228

Table 66. Adequacy and Importance of Professional Development Needs--1992 and 2002--Teacher Responses

	Adequacy				*Importance*			
	1992		*2002*		*1992*		*2002*	
	Mean	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*
Planning and delivering instruction								
All teachers	4.24	465	4.15	743	4.44	456	4.50	740
Elementary teachers	4.27	168	4.03	262	4.57	162	4.57	262
Mathematics teachers	4.28	159	4.20	252	4.43	156	4.45	250
Science teachers	4.14	138	4.23	229	4.31	138	4.47	228
Selecting and organizing materials								
All teachers	4.10	464	4.06	748	4.40	455	4.39	740
Elementary teachers	4.13	168	3.96	263	4.53	162	4.52	262
Mathematics teachers	4.12	158	4.13	254	4.37	155	4.30	250
Science teachers	4.05	138	4.11	231	4.27	138	4.34	228
Using instructional strategies such as cooperative learning and peer coaching								
All teachers	3.65	465	3.81	744	4.04	456	4.00	737
Elementary teachers	3.89	168	3.92	262	4.34	163	4.20	260
Mathematics teachers	3.52	159	3.63	253	3.86	155	3.88	250
Science teachers	3.51	138	3.88	229	3.87	138	3.89	227
Meeting the needs of underrepresented groups in mathematics and science								
All teachers	3.45	464	3.59	720	3.81	457	3.95	729
Elementary teachers	3.44	168	3.55	249	4.03	163	4.11	254
Mathematics teachers	3.42	159	3.58	248	3.64	156	3.86	250
Science teachers	3.50	137	3.64	223	3.75	138	3.87	225

Adequacy rating scale: 1=very inadequate, 2=inadequate, 3=neutral, 4=adequate, 5=very adequate

Importance rating scale: 1=very unimportant, 2=unimportant, 3=neutral, 4=important, 5=very important

Table 66. (continued)

	Adequacy				*Importance*			
	1992		*2002*		*1992*		*2002*	
	Mean	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*
Working with students with learning problems								
All teachers	3.43	463	3.58	739	4.10	453	4.32	718
Elementary teachers	3.72	168	3.67	258	4.43	163	4.55	248
Mathematics teachers	3.23	158	3.55	255	3.90	154	4.19	244
Science teachers	3.31	137	3.52	226	3.93	136	4.20	226
Utilizing multiple assessment measures								
All teachers	3.29	462	3.69	745	3.85	453	4.06	745
Elementary teachers	3.48	167	3.82	262	4.15	161	4.27	262
Mathematics teachers	3.06	158	3.45	254	3.65	155	3.83	252
Science teachers	3.34	137	3.80	229	3.74	137	4.07	231
Coordinating curriculum standards and benchmarks with assessment[a]								
All teachers	3.65	463	3.76	747	4.02	455	3.99	747
Elementary teachers	3.73	168	3.89	261	4.23	163	4.26	262
Mathematics teachers	3.57	158	3.65	255	3.88	155	3.86	254
Science teachers	3.64	137	3.75	231	3.94	137	3.82	231
Understanding and managing behavior problems in the classroom								
All teachers	4.07	464	4.00	747	4.36	457	4.51	743
Elementary teachers	4.22	168	4.07	262	4.58	164	4.65	260
Mathematics teachers	3.96	158	3.98	254	4.28	155	4.41	254
Science teachers	4.01	138	3.93	231	4.18	138	4.46	229

[a]In 1992, this item worded as coordinating curriculum objectives with assessment.

Table 66. (continued)

	Adequacy				*Importance*			
	1992		*2002*		*1992*		*2002*	
	Mean	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*
Organizing classroom learning opportunities in large-group, small-group, and individual settings								
All teachers	3.89	465	4.02	747	4.20	458	4.28	750
Elementary teachers	4.06	168	4.16	261	4.48	164	4.54	263
Mathemtics teachers	3.74	159	3.79	254	4.04	156	4.08	255
Science teachers	3.86	138	4.13	232	4.06	138	4.21	232
Using instructional technology in your classroom (e.g., computers, calculators with graphing capabilities)								
All teachers	3.44	465	3.44	746	4.36	455	4.17	745
Elementary teachers	3.36	168	3.22	261	4.42	164	4.08	260
Mathematics teachers	3.55	159	3.62	255	4.37	155	4.22	255
Science teachers	3.40	138	3.49	230	4.26	136	4.21	230
Content knowledge in mathematics								
All teachers	4.21	310	4.25	714	4.45	298	4.47	718
Elementary teachers	4.11	139	4.20	260	4.55	132	4.60	258
Mathematics teachers	4.31	156	4.50	251	4.41	152	4.55	252
Science teachers	4.13	15	4.00	203	3.86	14	4.22	208
Content knowledge in science								
All teachers	4.02	277	4.00	640	4.49	271	4.38	652
Elementary teachers	3.73	128	3.81	257	4.67	123	4.45	255
Mathematics teachers	4.13	15	3.72	155	4.43	15	4.03	170
Science teachers	4.28	134	4.43	228	4.53	133	4.56	227

Table 67. Comparison of Mathematics Teachers' Opinions on Professional Development/Inservice Training--1995 and 2002

	1995			2002		
	Mean	*S.D.*	*N*	*Mean*	*S.D.*	*N*
I need more opportunities for professional development/inservice training in content knowledge in mathematics.						
Elementary teachers	-	-	-	3.94	1.23	251
Mathematics teachers	-	-	-	3.49	1.42	252
All teachers	4.12	1.43	211	3.71	1.35	503
I need more opportunities for professional development/inservice training in incorporating NCTM standards.						
Elementary teachers	-	-	-	4.12	1.13	249
Mathematics teachers	-	-	-	4.04	1.18	252
All teachers	4.50	1.15	209	4.08	1.15	501

Rating scale: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree

1995 results available for all teachers combined only.

2002 results available for elementary teachers and mathematics teachers.

Table 68. Science Teachers' Opinions on Professional Development/Inservice Training--1995 and 2002

	1995			2002		
	Mean	*S.D.*	*N*	*Mean*	*S.D.*	*N*
I need more opportunities for professional development/inservice training in content knowledge in science.						
Elementary teachers	-	-	-	4.29	1.12	225
Science teachers	-	-	-	3.78	1.41	227
All teachers	4.43	1.25	174	4.03	1.30	452
I need more opportunities for professional development/inservice training in incorporating recent recommendations for science reform.						
Elementary teachers	-	-	-	4.34	1.09	222
Science teachers	-	-	-	4.19	1.18	227
All teachers	4.74	1.05	172	4.26	1.14	449

Rating scale: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree

1995 results available for all teachers combined only.

2002 results available for elementary teachers and science teachers only.

A similar pattern of higher need for inservice by the 1995 teacher respondents is also evident for other areas (Table 69). In 1995, over 40% of the teachers noted these areas as ones with high to very high need—working with students with learning problems (45%), using multiple assessment measures (46%), using instructional technology in teaching mathematics and science (66%), and using the ICN (50%). In 2002, using instructional technology in teaching mathematics and science was still a high need area for 40% of the teachers. In the other areas listed, fewer than 30% of the teachers indicated these areas as high need areas in 2002.

Implementing Reforms in K-12 Classrooms in Iowa

The implementation of reforms through curriculum revision and teacher knowledge of the standards for both mathematics and science was a focus of the surveys. This section contains the comparisons of results for questions addressing teacher preparation and effectiveness in incorporating reform in the classroom, communication about reform, types of reform incorporated, teacher inservice on reform, teacher familiarity with standards, and curriculum revision.

Overall, teachers in 2002 believed that they are more effective in incorporating the standards in their classrooms than they were in 1995 (Table 70). This was consistent for standards in all areas—instructional methods, curriculum changes, assessment, as well as overall. The teachers in 2002 also thought they were more effective in incorporating instructional technology than were the teachers in 1995.

While most teachers do not necessarily talk with their peers or administrators about reforms in mathematics and science, they have increased their communication about it over the past seven years (Table 71). About 40% of teachers in 2002 talk to teachers in their own district about reform at least monthly, an increase from 28% in 1995.

Table 69. Comparison of Teachers' Needs for Professional Development / Inservice Training--1995 and 2002

	No need	*Low need*	*Some need*	*High need*	*Very high need*	*Mean*	*S.D.*	*N*
Using instructional strategies such as cooperative learning and peer coaching								
All teachers--2002	11.3%	37.3%	42.3%	7.6%	1.5%	2.51	0.85	751
All teachers--1995	7.0%	23.3%	50.3%	15.0%	4.3%	2.86	0.91	300
Using strategies to meet the needs of underrepresented groups in mathematics and science								
All teachers--2002	9.0%	31.4%	44.9%	12.2%	2.5%	2.68	0.89	748
All teachers--1995	8.3%	31.0%	44.2%	12.5%	4.0%	2.73	0.92	303
Working with students with learning problems								
All teachers--2002	4.8%	21.1%	46.4%	23.6%	4.1%	3.01	0.90	750
All teachers--1995	2.0%	9.3%	43.9%	35.2%	9.6%	3.41	0.86	301
Using multiple assessment measures								
All teachers--2002	7.4%	25.3%	43.0%	20.2%	4.1%	2.88	0.95	752
All teachers--1995	4.0%	12.0%	38.5%	33.1%	12.4%	3.38	0.98	299
Aligning curriculum standards and benchmarks with assessment[a]								
All teachers--2002	11.5%	31.7%	32.8%	18.5%	5.5%	2.75	1.06	750
All teachers--1995	4.0%	17.4%	45.5%	24.4%	8.7%	3.16	0.95	299

Rating scale: 1=no need, 2=low need, 3=some need, 4=high need, 5=very high need

[a]In 1995, the question was worded as coordinating curriculum objectives with assessment.

Table 69. (continued)

	No need	*Low need*	*Some need*	*High need*	*Very high need*	*Mean*	*S.D.*	*N*
Understanding and managing behavior problems in the classroom								
All teachers--2002	14.0%	34.0%	31.0%	13.5%	7.5%	2.66	1.11	748
All teachers--1995	4.7%	24.1%	35.8%	20.7%	14.7%	3.17	1.10	299
Organizing classroom learning opportunities in large-group, small-group, and individual settings								
All teachers--2002	14.2%	37.0%	34.4%	10.5%	3.9%	2.53	0.99	751
All teachers--1995	2.7%	19.6%	45.8%	22.9%	9.0%	3.16	0.93	301
Using instructional technology in teaching mathematics and science								
All teachers--2002	4.3%	14.0%	42.0%	29.6%	10.1%	3.27	0.97	750
All teachers--1995	0.7%	5.7%	27.5%	39.6%	26.5%	3.86	0.90	298
Using the Iowa Communications Network (ICN), Iowa's fiber-optic telecommunications network								
All teachers--2002	15.7%	28.4%	34.4%	16.7%	4.8%	2.66	1.08	750
All teachers--1995	6.1%	14.9%	29.2%	27.8%	22.0%	3.45	1.17	295

Table 70. Comparison of Teachers' Effectiveness of Incorporating Reform in the Classroom--1995 and 2002

	1995			2002		
	Mean	*S.D.*	*N*	*Mean*	*S.D.*	*N*
Mathematics and / or science standards overall						
All teacher respondents	4.43	0.83	300	4.62	0.85	739
Elementary teachers				4.61	0.80	259
Mathematics teachers				4.63	0.80	250
Science teachers				4.63	0.94	230
Mathematics and / or science standards related to instructional methods						
All teacher respondents	4.25	0.86	298	4.51	0.82	730
Elementary teachers				4.57	0.80	257
Mathematics teachers				4.46	0.75	246
Science teachers				4.49	0.92	227
Mathematics and / or science standards related to curriculum changes						
All teacher respondents	4.23	0.87	295	4.44	0.87	727
Elementary teachers				4.47	0.81	255
Mathematics teachers				4.41	0.88	247
Science teachers				4.45	0.94	225
Mathematics and / or science standards related to assessment practices						
All teacher respondents	3.91	0.94	290	4.22	0.93	728
Elementary teachers				4.30	0.86	256
Mathematics teachers				4.11	0.91	247
Science teachers				4.25	1.02	225
Instructional technology						
All teacher respondents	3.62	1.11	294	3.84	1.07	734
Elementary teachers				3.48	1.01	251
Mathematics teachers				4.04	1.08	253
Science teachers				4.02	1.03	230

Rating scale: 1=very ineffective, 2=ineffective, 3=somewhat ineffective, 4=somewhat effective, 5=effective, 6=very effective

1995 results available for all teachers combined only.

Table 71. Comparison of Frequency of Communication about Reform in Mathematics and Science--1995 and 2002

	Never	*A few times a year*	*Monthly*	*Weekly*	*Daily*	*N*
Communicate with teachers in your district about recent reforms in mathematics and/or science						
All teacher respondents--2002	12.9%	46.5%	26.8%	11.6%	2.3%	751
All teacher respondents--1995	9.6%	62.0%	19.5%	7.6%	1.3%	303
Communicate with teachers outside of your district about recent reforms in mathematics and/or science						
All teacher respondents--2002	41.0%	49.1%	6.8%	2.4%	0.8%	752
All teacher respondents--1995	34.4%	58.6%	6.3%	0.3%	0.3%	302
Communicate with administrators in your school about reforms in mathematics and/or science						
All teacher respondents--2002	24.7%	53.6%	17.0%	3.9%	0.8%	752
All teacher respondents--1995	19.1%	65.7%	12.5%	2.3%	0.3%	303

Demonstration classrooms were a focus of survey in 1995. Teachers in 2002 continued to think that they are somewhat to very effective in helping teachers learn how to incorporate standards-based reform in their own classrooms (Table 72). The ratings by about 80% of teachers in both 1995 and 2002 indicate that demonstration classrooms have value.

Teachers also described the types of reform they were incorporating into their classrooms (Table 73). In 1995, about half of the teachers (46%) were incorporating reforms related to curriculum changes, assessment practices, and instructional methods, and an additional one-fourth were focusing on curriculum changes and instructional methods. By 2002, over half (56%) were incorporating reforms related to curriculum changes, assessment practices, and instructional methods, and a higher percentage of teachers were incorporating standards related to assessment practices.

There was little difference in the amount of inservice training received by teachers from 1995 to 2002 (Table 74). At both surveys, over one-fourth of the teachers reported that they had received no training in recent reforms and about one-third received two to five days of training. Further, about one-third of the teachers at both surveys had applied their skills and knowledge about the reforms in their classroom quite a bit or extensively, one-third some, and another one-third a little or not at all (Table 75).

Implementing Reforms in Mathematics

This section presents the comparison of results for implementing reforms in mathematics. Information about changes in teacher familiarity with the standards, curriculum revision, and confidence in implementing the standards is included for elementary and secondary mathematics teachers from 2002, all teachers combined from 1995, and elementary and secondary mathematics teachers from 1992.

Table 72. Comparison of Effectiveness of Demonstration Classrooms in Helping Teachers Learn about Reform--1995 and 2002

	Very ineffective	*Ineffective*	*Somewhat ineffective*	*Somewhat effective*	*Effective*	*Very effective*	*Mean*	*S.D.*	*N*
Effectiveness of demonstration classrooms in helping teachers learn how to incorporate mathematics and science standards-based reforms in their own classrooms									
All teacher respondents--2002	9.3%	3.9%	8.6%	37.0%	30.5%	10.6%	4.07	1.35	557
All teacher respondents--1995	7.8%	4.1%	8.1%	35.9%	32.5%	11.5%	4.16	1.31	295

Rating scale: 1=very ineffective, 2=ineffective, 3=somewhat ineffective, 4=somewhat effective, 5=effective, 6=very effective

Table 73. Comparison of Types of Reforms Incorporated in the Classroom--1995 and 2002

	Curriculum changes only	*Assessment practices only*	*Instructional methods only*	*Curriculum changes and assessment practices*	*Curriculum changes and instructional methods*	*Assessment practices and instructional methods*	*All three types (curriculum, assessment, and instruction)*	*N of valid responses*	*Number not incorporating any reforms*
Types of reform consistent with the recent mathematics and/or science standards that have been incorporated in your classroom.									
All teachers--2002	4.7%	2.3%	1.7%	13.2%	13.3%	8.5%	56.2%	697	45
All teachers--1995	7.7%	0.0%	4.8%	9.6%	27.6%	4.8%	45.6%	272	28

Table 74. Comparison of Amount of Inservice Training in Recent Reforms--1995 and 2002

	None	*1 day only*	*2-5 days total*	*1-2 weeks total*	*3 weeks or more, not consecutively*	*3 consecutive weeks*	*3 consecutive weeks, plus additional training*	*N*
Total amount of inservice training in recent types of mathematics and/or science reforoms such as those recommended by the National Council of Teachers of Mathematics (NCTM) and/or the National Academy of Science (NAS)								
All teachers--2002	26.4%	13.4%	34.5%	12.8%	10.3%	0.1%	2.6%	740
All teachers--1995	25.2%	15.6%	31.6%	14.6%	8.0%	0.3%	4.7%	301

Table 75. Comparison of Frequency of Application of Skills and Knowledge--1995 and 2002

	None	A little	Some	Quite a bit	Extensively	Mean	S.D.	N
To what extent have you applied the skills and knowledge you learned in this training in your classroom								
All teachers--2002	23.4%	14.0%	31.5%	24.6%	6.5%	2.77	1.24	723
All teachers--1995	19.9%	17.2%	34.0%	22.3%	6.5%	2.78	1.19	291

About 70% of the mathematics teachers reported that they are fairly to very familiar with the NCTM standards at their grade level (Table 76). This percentage has remained consistent since 1992. Over half of the elementary teachers (56%) reported that they are fairly to very familiar with the NCTM standards at their grade level, an increase from 35% in 1992. The percentages of teachers who are fairly or very familiar with NCTM standards for all grade levels were consistent from 1992 to 2002. Fewer elementary teachers in 2002 reported that they do not know about the standards.

Table 77 shows that the NCTM standards have been incorporated in district mathematics curriculum revisions increasingly since 1992. Most, if not all, teachers reported that the standards would be included in the next revision. There were some changes in teacher attitude about district policy for adhering to the mathematics curriculum. There was a slight shift, with a larger percentage of teachers recognizing the mathematics curriculum as required. Fifteen percent of secondary mathematics teachers continued to think of it as voluntary.

In 1992, about 60% of the teachers indicated that they had completed a curriculum revision within the last two years (Table 78), and half expected the next revision to occur in the next two years. Similar percentages were reported in 1995 and 2002.

Table 76. Comparison of Mathematics Teachers' Familiarity with the National Mathematics Standards--1992, 1995, and 2002

	Don't know about them	*Know a little about them*	*Fairly familiar with them*	*Very familiar with them*	*Completely familiar with them*	*N*
Familiarity with the national mathematics standards (such as NCTM or MCREL) for your grade level						
Elementary teachers--2002	7.6%	33.5%	33.1%	22.7%	3.2%	251
Mathematics teachers--2002	2.8%	19.0%	40.9%	29.8%	7.5%	252
All teachers--1995	12.7%	36.8%	33.5%	12.7%	4.2%	212
Elementary teachers--1992	27.5%	33.1%	20.4%	14.8%	4.2%	142
Mathematics teachers--1992	3.7%	19.3%	39.8%	34.2%	3.1%	161
Familiarity with the national mathematics standards for all grade levels						
Elementary teachers--2002	19.3%	54.7%	22.0%	3.5%	0.4%	254
Mathematics teachers--2002	6.7%	45.2%	37.3%	10.3%	0.4%	252
All teachers--1995	19.7%	48.4%	24.4%	6.6%	0.9%	213
Elementary teachers--1992	44.0%	27.5%	22.0%	5.5%	0.9%	109
Mathematics teachers--1992	7.4%	34.8%	37.0%	13.3%	7.4%	135

Table 77. Comparison of Incorporation of National Mathematics Standards in Mathematics Curriculum--1992, 1995, and 2002

	NCTM standards in last curriculum revision						*NCTM standards in next curriculum revision*				*Policy for adhering to math curriculum*			
	Yes,extensively	*Yes, somewhat*	*Yes, a little*	*No*	*N of valid responses*	*Number don't know*	*Yes*	*No*	*N of valid responses*	*Number don't know*	*Required*	*Suggested*	*Voluntary*	*N of valid responses*
Elementary teachers--2002	51.8%	38.1%	6.6%	3.6%	197	54	98.2%	1.8%	163	83	64.1%	33.5%	2.4%	245
Mathematics teachers--2002	47.1%	35.0%	11.7%	6.3%	206	46	97.5%	2.5%	157	92	38.2%	46.7%	15.0%	246
All teachers--1995	33.7%	38.1%	14.4%	13.7%	160	51	100.0%	0.0%	119	89	34.1%	45.0%	20.9%	211
Elementary teachers--1992	36.5%	43.2%	4.1%	16.2%	74	79	100.0%	0.0%	71	83	57.0%	39.1%	4.0%	157
Mathematics teachers--1992	23.3%	43.8%	15.1%	17.8%	146	29	100.0%	0.0%	119	59	30.9%	53.7%	15.4%	175

Table 78. Comparison of Recent and Expected Mathematics Curriculum Revisions --1992, 1995, and 2002

	Last completed curriculum revision						*Expect the next curriculum revision*					
	Within the last year	*1 to 2 years ago*	*3 to 4 years ago*	*5 or more years ago*	*N of valid responses*	*Number don't know*	*Currently under revision*	*Within the next 1 to 2 years*	*Within the next 3 to 4 years*	*Within the next 5 years*	*N of valid responses*	*Number don't know*
Elementary teachers--2002	23.9%	28.0%	27.1%	21.1%	218	34	26.2%	28.0%	22.6%	23.2%	168	84
Mathematics teachers--2002	25.7%	31.2%	27.1%	16.1%	218	34	26.6%	24.3%	25.4%	23.7%	177	75
All teachers--1995	26.4%	27.4%	26.4%	19.8%	197	15	27.9%	29.2%	23.4%	19.5%	154	56
Elementary teachers--1992	-	-	-	-	-	-	NA	47.5%	22.9%	29.7%	118	35
Mathematics teachers--1992	-	-	-	-	-	-	NA	52.7%	20.9%	26.4%	129	47
All teachers--1992	23.2%	35.3%	20.3%	21.1%	241	78	-	-	-	-	-	-

Mathematics teachers in 1992 were confident that they were well prepared to implement NCTM standards in the classroom (Table 79). By 1995, their opinion was not as positive. In 2002, secondary mathematics teachers somewhat agreed that they are well prepared to implement the NCTM standards; however they still are not as confident in their preparation to implement the standards as teachers were in 1995. Additionally, teachers in 2002 were not as sure that the reforms in mathematics are having a positive impact on student learning as were teachers in 1995.

Implementing Reforms in Science

This section presents the comparison of results for implementing reforms in science. Information about changes in teacher familiarity with the standards, curriculum revision, and confidence in implementing standards is included for elementary and secondary science teachers from 2002, all teachers combined from 1995, and elementary and secondary science teachers from 1992.

In 1992, 82% of the elementary teachers and 72% of the secondary science teachers knew little or nothing about science standards at their own grade level (Table 80). By 2002, although less, a large percentage of elementary teachers (67%) still knew little or nothing about the science standards. About two-thirds of the science teachers were fairly to very familiar with the science standards for their own grade level.

Even fewer teachers were familiar with the science standards for all grade levels. Although 45% of the secondary science teachers were fairly to very familiar with standards for all grade levels, an additional 53% are not. Eighty-five percent of elementary knew little or nothing about standards at all grade levels.

Table 81 shows that the science standards have been incorporated in district science curriculum revisions increasingly since 1992. Many of the science

Table 79. Comparison of Mathematics Teachers' Opinions on Mathematics Reform--1992, 1995, and 2002

	1992			*1995*			*2002*		
	Mean	*S.D.*	*N*	*Mean*	*S.D.*	*N*	*Mean*	*S.D.*	*N*
I feel well prepared to implement the NCTM standards in my classroom.									
Elementary teachers	4.41	1.18	151	-	-	-	3.67	1.27	249
Mathematics teachers	4.38	1.13	175	-	-	-	4.08	1.17	251
All teachers	-	-	-	3.52	1.32	209	3.88	1.24	500
Reforms in mathematics have had a positive impact on student learning.									
Elementary teachers	-	-	-	-	-	-	4.10	0.95	248
Mathematics teachers	-	-	-	-	-	-	3.89	1.04	249
All teachers	-	-	-	4.43	0.91	208	4.00	1.00	497

Rating scale: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree

1995 results available for all teachers combined only.

1992 and 2002 results available only for elementary teachers and mathematics teachers.

1992 5-point scale converted to 6-point scale for comparison.

Table 80. Comparison of Science Teachers' Familiarity with the National Science Education Standards--1992, 1995 and 2002

	Don't know about them	*Know a little about them*	*Fairly familiar with them*	*Very familiar with them*	*Completely familiar with them*	*N*
Familiarity with the National Science Education Standards (NSES) for your grade level						
Elementary teachers--2002	24.1%	43.0%	22.8%	7.5%	2.6%	228
Science teachers--2002	2.2%	25.4%	39.0%	25.4%	7.9%	228
All teachers--1995	29.7%	38.4%	22.1%	0.7%	1.2%	172
Elementary teachers--1992	52.6%	29.3%	10.5%	6.0%	1.5%	133
Science teachers--1992	31.5%	40.4%	18.5%	6.8%	2.7%	146
Familiarity with the National Science Education Standards (NSES) for all grade levels						
Elementary teachers--2002	39.9%	45.2%	8.8%	6.1%	0.0%	228
Science teachers--2002	6.1%	47.4%	32.5%	12.3%	1.8%	228
All teachers--1995	43.6%	41.9%	9.3%	5.2%	0.0%	172
Elementary teachers--1992	64.8%	23.1%	6.6%	2.2%	3.3%	91
Science teachers--1992	39.3%	42.9%	10.7%	4.5%	2.7%	112

Table 81. Comparison of Incorporation of National Science Education Standards in Science Curriculum--1992, 1995, and 2002

	NSES standards in last curriculum revision						*NSES standards in next curriculum revision*				*Policy for adhering to science curriculum*			
	Yes,extensively	*Yes, somewhat*	*Yes, a little*	*No*	*N of valid responses*	*Number don't know*	*Yes*	*No*	*N of valid responses*	*Number don't know*	*Required*	*Suggested*	*Voluntary*	*N of valid responses*
Elementary teachers--2002	36.6%	45.5%	11.6%	6.3%	112	115	71.4%	28.6%	168	47	53.4%	42.5%	4.1%	219
Science teachers--2002	36.4%	40.5%	13.9%	9.2%	173	54	82.1%	17.9%	184	42	45.0%	42.3%	12.7%	220
All teachers--1995	13.1%	41.7%	16.7%	28.6%	84	86	98.4%	1.6%	64	106	24.4%	48.3%	27.3%	172
Elementary teachers--1992	16.3%	46.5%	16.3%	20.9%	43	94	97.2%	2.8%	36	104	47.1%	47.8%	5.1%	136
Science teachers--1992	8.3%	29.8%	27.4%	34.5%	84	65	96.3%	3.7%	54	96	26.3%	54.6%	19.1%	152

teachers reported that the standards would be included in the next revision at each survey time. Like mathematics, there were some changes in teacher attitude about district policy for adhering to the science curriculum. There was a slight shift, with a larger percentage of teachers recognizing the science curriculum as required. About 13% of science teachers continued to think of it as voluntary.

In 1992, 61% of the science teachers indicated that they had completed a curriculum revision within the last two years (Table 82), and one-third to half expected the next revision to occur in the next two years. Similar percentages were reported in 2002.

Like the mathematics teachers, science teachers in 1992 were relatively confident that they were well prepared to implement science standards in the classroom (Table 83). In 1995, their opinion was not as positive. In 2002, secondary science teachers somewhat agreed that they are well prepared to implement the science standards, similar to their rating in 1992. Additionally, teachers in 2002 were not as sure that the reforms in science are having a positive impact on student learning as were teachers in 1995.

Use of Technology

There was a notable change in the opinions of the teachers from 1995 to 2002 regarding the use of technology in the classroom. In 1995, 65% of the teachers reported never using electronic communication such as email or the internet, and 18% used it only a few times a year (Table 84). By 2002, 88% were using it daily. Further, only 7% of the teachers in 1995 provided opportunities for their students to use electronic communication monthly or more often. By 2002, this number had increased to 47%. However, a majority of teachers are still not providing students with the opportunity to use email and the internet routinely.

Table 82. Comparison of Recent and Expected Science Curriculum Revisions--1992, 1995, and 2002

	Last completed curriculum revision						*Expect the next curriculum revision*					
	Within the last year	*1 to 2 years ago*	*3 to 4 years ago*	*5 or more years ago*	*N of valid responses*	*Number don't know*	*Currently under revision*	*Within the next 1 to 2 years*	*Within the next 3 to 4 years*	*Within the next 5 years*	*N of valid responses*	*Number don't know*
Elementary teachers--2002	17.4%	30.9%	28.1%	23.6%	178	50	16.4%	26.6%	31.3%	25.8%	128	101
Science teachers--2002	30.0%	37.5%	19.0%	13.5%	200	26	30.2%	27.0%	24.5%	18.2%	159	68
All teachers--1995	17.8%	21.2%	29.5%	31.5%	146	26	16.7%	37.5%	27.5%	18.3%	120	53
Elementary teachers--1992	-	-	-	-	-	-	NA	37.2%	20.9%	41.9%	86	56
Science teachers--1992	-	-	-	-	-	-	NA	49.1%	34.3%	16.7%	108	47
All teachers--1992	29.6%	31.1%	18.9%	20.3%	196	89	-	-	-	-	-	-

Table 83. Comparison of Science Teachers' Opinions on Science Reform--1992, 1995, and 2002

	1992			*1995*			*2002*		
	Mean	*S.D.*	*N*	*Mean*	*S.D.*	*N*	*Mean*	*S.D.*	*N*
I feel well prepared to implement in my classroom the recommendations for science reform as outlined in the National Science Education Standards.									
Elementary teachers	3.96	1.24	138	-	-	-	3.19	1.30	223
Science teachers	4.13	1.22	151	-	-	-	4.07	1.24	226
All teachers	-	-	-	2.87	1.34	173	3.63	1.34	449
Reforms in science have had a positive impact on student learning.									
Elementary teachers	-	-	-	-	-	-	3.93	1.00	220
Science teachers	-	-	-	-	-	-	3.92	1.11	225
All teachers	-	-	-	4.44	0.99	170	3.93	1.05	445

Rating scale: 1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree

1992 5-point scale converted to a 6-point scale for comparison.

Table 84. Comparison of Frequency of Use of Technology in Classroom--1995 and 2002

	Never	*As few times a year*	*Monthly*	*Weekly*	*Daily*	*N*
Use electronic communication (e.g., internet, email)						
All teachers--2002	0.9%	2.1%	1.9%	6.5%	88.5%	750
All teachers--1995	65.0%	17.5%	3.3%	8.3%	5.9%	303
Provide opportunities for your students to use electronic communication						
All teachers--2002	22.8%	29.9%	16.3%	20.2%	10.8%	749
All teachers--1995	73.6%	19.8%	2.0%	3.3%	1.3%	303

The frequency of use of the ICN has also increased since 1995, according to these teachers (Table 85). In 1995, about one-third of the teachers used the ICN for professional development activities; about two-thirds of the teachers responding to the 2002 surveys reported using it for professional development. While most teachers do not use the ICN to provide instructional activities for their students, twice as many use it with their students in 2002 (24%) than did in 1995 (12%).

Summary

The 2002 Iowa Mathematics and Science Needs Assessment is the third in a series of studies examining reform in mathematics and science in Iowa schools. In the past ten years, reform efforts in mathematics and science have included the advent of national standards and subsequent efforts to integrate these standards into curriculum and implement them in classrooms, many and varied opportunities for professional development of teachers so that they can teach to the standards, and shortages of teachers in both subject areas. Recent state (HF2272) and federal legislation (*No Child Left Behind*) raise new concerns about learning and teaching in mathematics and science, requiring educators at all levels to have accurate and credible information as they are making decisions. This 2002 study builds on the results of previous studies in 1992 and 1995 and looks to the future of mathematics and science education in Iowa.

Purpose of the 2002 Iowa Mathematics and Science Needs Assessment

The 2002 Iowa Mathematics and Science Needs Assessment was intended to provide the following:

- Data that indicate progress made in the level of awareness and implementation of national mathematics and science standards.

Table 85. Comparison of Frequency of Use of the ICN--1995 and 2002

	Yes	*No*	*N*
Have you used the ICN (Iowa's fiber optic network) for professional development activities (i.e., inservice, meetings, colleges classes)?			
All teachers--2002	63.1%	36.9%	750
All teachers--1995	31.7%	68.3%	303
Have you used the ICN to provide instructional activities for your students (i.e., speakers, special events, courses)?			
All teachers--2002	24.0%	76.0%	751
All teachers--1995	11.9%	88.1%	302

- Data that address teacher quality and teacher shortage in mathematics and science.
- Data that can be used in improving teacher preparation programs.
- Data that provide information that supports applications for grants, such as mathematics and science partnerships.

In addition, the results of this study will assist school districts, Area Education Agencies (AEAs), higher education institutions, and the Iowa Department of Education in setting direction and focus in mathematics and science education that is aligned with legislative requirements and meets the needs of Iowa's school districts.

Methodology

The Iowa Department of Education, in conjunction with the Research Institute for Studies in Education (RISE), College of Education at Iowa State University, conducted the 2002 Iowa Mathematics and Science Needs Assessment. The 2002 study was conducted by mail survey during September and October 2002. Survey participants included 1132 Iowa teachers, superintendents, AEA mathematics and science coordinators, and selected higher education mathematics and science education faculty. Responses to these surveys were received from 49% of the teachers, 83% of the superintendents, 93% of the AEA mathematics and science coordinators, and 80% of the higher education mathematics and science faculty surveyed.

Results

The results of the 2002 Iowa Mathematics and Science Needs Assessment contain information for several topic areas that represent state or national initiatives. A summary of the key findings in each of these topic areas follows.

- Teacher preparation and licensure

- Improving mathematics and science
- Teacher professional development
- Implementing reform in K-12 classrooms in Iowa
- Integrating environmental education
- Assessment
- Use of technology
- AEA issues
- Teacher supply and demand
- Partnerships
- National initiatives—No Child Left Behind

Teacher Preparation and Licensure

Preparing teachers to have an understanding and working knowledge of the content and standards in mathematics and science is important in providing quality education. Teachers and higher education faculty responded to questions related to teacher preparation and licensure.

For the most part, teachers reported that they are well prepared to teach mathematics and science, particularly at the middle and high school levels. While elementary teachers were confident in their preparation to teach mathematics and science, many secondary mathematics and science teachers disagreed that elementary teachers are adequately prepared. Teachers also reported that, in general, they were well prepared to integrate technology and environmental education into their teaching.

Like the teachers, faculty respondents were positive about the preparation of mathematics education majors at the secondary level. About two-thirds of them indicated that their institutions adequately prepared elementary education majors to teach mathematics and science. College and university science faculty reported that their institutions adequately prepared secondary science majors. They also thought that they were adequately addressing mathematics and

science standards in their teacher preparation programs. A marked difference was evident between mathematics and science programs in the amount of time students spend in practicum experiences prior to student teaching. Most mathematics students spend up to eight weeks in practicum experiences, while over half of the science students spend more than 15 weeks.

Higher education mathematics and science faculty were split when asked whether their programs would grow stronger over the next five years. Faculty respondents wrote that positive changes in programs would likely be attributed to curricular improvements, increased student interest, committed and well qualified faculty, a new licensure program, a continual process of evaluation and improvement, and a willingness to change and adapt. Lack of funding, loss of faculty, and lack of support from college and university administration were cited as reasons for weakening programs.

Teachers generally thought that the current requirements for licensure in mathematics were sufficient for elementary, middle school, and high school teachers. One exception was that only 22% of the secondary mathematics teachers thought that the requirements were sufficient for elementary teachers and recommended that elementary pre-service teachers need better foundations in mathematics, more methods classes, and experiences in real classrooms. Unlike teachers, few faculty at Iowa's colleges and universities thought licensure requirements were sufficient at any level. Faculty respondents made similar recommendations to address insufficient licensure requirements.

Teachers and higher education faculty respondents gave similar responses about the sufficiency of licensure requirements in science for elementary, middle school, and high school teachers. Like for mathematics, they suggested that a broader science background with more content knowledge and science methods courses, as well as classroom experiences, would address insufficient licensure requirements.

Improving Mathematics and Science

Teachers and superintendents, and AEA coordinators offered opinions about improving mathematics and science education and examined areas of need, possible strategies that could be used, and key issues related to teacher quality, recruitment, and retention.

Teachers and superintendents agreed that leadership or assistance from teachers, building administrators, and the AEAs, as well as quality instructional materials, were adequate and important in improving mathematics and science. Other factors that were seen as important by both teachers and superintendents included (1) opportunities for teachers to share ideas and strategies with their peers, reflect on their own teaching, and participate in teacher inservice activities in mathematics and science; (2) a sufficient level of funding for science and mathematics; (3) teachers' awareness of the uses of, as well as their skills in utilizing, appropriate instructional technology in mathematics and science and the availability of appropriate instructional technology in the classroom for teaching mathematics and science; and (4) knowledge about reform efforts.

Areas of need, where importance was high but adequacy was low, were also examined. Teachers reported that funding for mathematics and science, leadership or assistance from universities and the Iowa Department of Education, and articulation between levels in both mathematics and science were areas of need in 2002. Elementary teachers also saw a need for appropriate instructional technology and improved skills in using technology in the classroom for teaching mathematics and science. Further, areas of need in improving mathematics and science noted by secondary mathematics and science teachers included parent, community, and business involvement in reform efforts and opportunities for teacher inservice activities.

In a comparison with the results from 1992, fewer areas of need were reported in 2002, a result of teachers reporting increased adequacy for these topics. Areas of need listed in 1992, but no longer listed in 2002, include level of

funding (elementary teachers), leadership from counselors or curriculum supervisors (secondary science teachers), communication among educators, parents, community members, and business leaders (secondary mathematics teachers), involvement of parents, community members, and business leaders in reform efforts (elementary teachers), opportunities for teachers to share ideas and strategies with peers (secondary science teachers), use of multiple assessment measures (secondary mathematics and science teachers), and availability of appropriate instructional technology (secondary mathematics and science teachers).

From a list of possible strategies for improving mathematics and science education, teachers agreed that additional funding for equipment, facilities, and staff was needed. They also indicated that teachers need more opportunities to participate in inservice activities in their subject areas. Other key strategies seen as important for improving mathematics and science included increasing instructional time in mathematics and science at the elementary level, requiring elementary teachers to take more mathematics and science courses at the undergraduate level, and forming partnerships with universities and the private sector.

The quality of teachers, attracting them to the profession, and retaining them are seen as key in improving mathematics and science education in Iowa. Teachers, superintendents, and AEA coordinators saw five issues related to recruiting and retaining quality teachers—(1) salary and funding, (2) content knowledge and teaching strategies, (3) resources, (4) environment, government relations, and support, and (5) the unique challenges of rural and small school districts. They wrote about adequate pay, funding for salaries, and incentives for those teaching mathematics and science. They addressed the need for increased content knowledge, sound pedagogy, professional development, strong undergraduate training and teacher preparation, the use of multiple teaching strategies and effective teaching methods, and the incorporation of standards

and benchmarks. They voiced concerns about the need for appropriate equipment, lack of time, and workload. They addressed support from mentors; the need for increased collaboration; classroom management and safe environments; teacher retirement and attrition; certification and licensure requirements; government guidelines and increased paperwork; and support of administrators, parents, and legislators. Finally, they wrote about lack of incentives to keep quality teachers in Iowa's rural and smaller schools.

Teacher Professional Development

The continuing professional development of Iowa's teachers is essential to retaining quality teachers. Teacher professional development needs were reported as generally met in 2002, as they were in 1992. However, selected areas of need for professional development remain.

Teachers agreed that they were adequately prepared in content knowledge in mathematics and science, planning and delivering instruction, selecting and organizing materials, organizing classroom learning opportunities, and understanding and managing behavior problems in the classroom. In contrast to their responses to a similar question where teachers felt that they had been well prepared in their teacher preparation programs, they noted that they were not as well prepared to incorporate environmental education and use instructional technology in the classroom when considering professional development.

Several of these areas and others were mentioned as important—understanding and managing behavior problems in the classroom, selecting and organizing materials, working with students with learning problems, making accommodations for students with special needs, organizing classroom learning opportunities, using instructional technology in the classroom, utilizing multiple assessments, and using instructional strategies such as cooperative learning and peer coaching.

Despite adequate preparation in many areas, professional development needs were evident for teachers. Seventy to eighty percent of elementary teachers and a majority of secondary mathematics and science teachers agreed that they need more opportunities for professional development in content knowledge and incorporating standards. More than half of the teachers reported their need for professional development or inservice training in specific areas—using instructional technology in teaching mathematics and science, working with students with learning problems, using multiple assessments, using strategies to meet the needs of underrepresented groups in mathematics and science, using environmental education strategies to enhance the curriculum, aligning curriculum standards and benchmarks with assessment, using the Iowa Communications Network (ICN), and using instructional strategies such as cooperative learning and peer coaching.

To provide opportunities for professional development for mathematics and science teachers, superintendents planned to set aside funds from the Title II allocation for 2002-2003. They anticipated using the funds for a variety of activities, including aligning standards and benchmarks with assessments, teacher participation in workshops or mathematics and science conferences, working with AEA coordinators, paying for teacher collaborations, funding mentoring programs, and enhancing content background in mathematics and science.

The AEAs and higher education institutions play a key role as partners with local schools by providing professional development activities for teachers. Their suggestions that the Regent's higher education (competitive grant) program for professional development focus on enhancing content, implementing national standards into the curriculum, and incorporating inquiry-based learning in mathematics and science are consistent with needs expressed by teachers. Further, they recommended that emphasis for professional development in mathematics should address learning styles and how they

impact mathematics instruction, differentiated instructional strategies, how to use assessment to inform instruction, integrating technology, and keeping a focus on student learning by improving content knowledge and understanding. For science, two primary areas of focus were suggested—programs to help teachers implement inquiry-based instruction and aligning instruction with standards, benchmarks, and assessments.

Finally, teachers, superintendents, AEA coordinators, and higher education faculty suggested the best ways for teachers to learn about mathematics and science reform. There was agreement from all four groups that participating in professional development activities, such as targeted inservices or workshops with hands-on activities, was the best way. Other ways for learning about mathematics and science reform included peer assistance and mentoring, reading research and practitioner publications, attending mathematics and science conferences, and taking graduate level courses.

Implementing Reforms in K-12 Classrooms in Iowa

A key finding of the 2002 Needs Assessment is understanding how reforms in mathematics and science are being implemented in K-12 classrooms in Iowa. Teachers were asked to indicate how effective they have been in incorporating mathematics and science standards in their classrooms, how they talk about and work with their colleagues regarding standards, and how they incorporate the standards into their teaching. Superintendents and AEA coordinators provided information on how local standards and benchmarks have affected student achievement and instruction, and teachers and superintendents reported about revisions to their curricula. Finally, all respondent groups wrote about effective ways that their educational partners could assist teachers in incorporating reform into their classrooms.

Many of the teachers in 2002 (56%) have incorporated changes in curriculum, instructional methods, and assessment reforms consistent with the

recent standards. In 1995, 46% were incorporating reforms. In 2002, they reported that they have been effective in incorporating the standards overall and standards related to instructional methods and curriculum changes, although they thought they have been less effective in incorporating standards related to assessment practices. Overall, teachers in 2002 believed that they are more effective in incorporating the standards in their classrooms than they were in 1995. This was consistent for standards related to instructional methods, curriculum changes, and assessment, as well as overall.

While most teachers do not necessarily talk with their peers or administrators about reforms in mathematics and science, they have increased their communication about it over the past seven years. About 40% of teachers in 2002 talked to teachers in their own district about reform at least monthly, an increase from 28% in 1995.

Most teachers reported that they had participated in inservice training related to mathematics and science reform. About one-third noted a total of two to five days of training and an additional 10% of all teachers had at least three weeks of inservice training. Further, most are applying what they have learned in these inservices in their classrooms. There was little difference in the amount of inservice training received by teachers from 1992 to 2002.

Teachers described their familiarity with the standards and reported on recent curriculum revisions in their districts. Consistent since 1995, most elementary and secondary mathematics teachers in 2002 were familiar with mathematics standards at their own level. Not surprisingly, they were not as familiar with the standards at the other levels. Science teachers reported similar results. Only about one-third of elementary teachers were familiar with the science standards, although over 70% of secondary science teachers were familiar with the standards. Again, they were even less familiar with the standards at the other grade levels.

Most teachers indicated that the mathematics curriculum in their district was revised within the last two years, was currently under revision, or would be revised within the next two years. About half of them reported that the mathematics standards had been incorporated extensively into recent curriculum revisions and almost all of these teachers indicated that they would be incorporated extensively in the next revision. As expected, the NCTM standards have been increasingly incorporated into district mathematics curriculum revisions since 1992. There were some changes in teacher attitude in 2002 about district policy for adhering to the mathematics curriculum as required. There was a slight shift, with a larger percentage of teachers recognizing the curriculum as required. Fifteen percent of secondary mathematics teachers continue to think of it as voluntary.

Like mathematics, most science curricula have been recently revised or will be revised in the next two years. The science standards currently do not appear to be as extensively incorporated into the curriculum revisions as are the mathematics standards, but those with science curriculum revisions underway or expected plan to incorporate science standards extensively. About half of elementary and secondary science teachers think that they are required to adhere to the science curriculum, up from about 25% in 1995.

In 2002, curriculum revisions are most often underway or expected in the next two years in the smallest districts in Iowa. Larger districts have more often recently completed their revisions and do not expect to make revisions for another five years.

Mathematics and science teachers have strong opinions about reform in their subject areas. About 40% of secondary teachers agree that they are well prepared to implement the standards in their classrooms, while one-fourth to one-third of the elementary teachers disagreed that they are prepared. Most mathematics teachers thought that they were prepared to address the Iowa teaching standards and the NCTM standards. Secondary science teachers felt

prepared to address the NSES standards and that they had adequate preparation to teach science subjects. Many elementary teachers noted the need for better preparation to teach to the standards, address closing the achievement gap, and address special needs of students. Despite their preparation and willingness to implement the standards in their classrooms, only about one in four teachers agreed or strongly agreed that reforms in mathematics and science have had a positive impact on student learning, a less positive response than in 1995.

Like teachers, a majority of superintendents were familiar with standards for mathematics and science. However, about one-fourth to one-third of the superintendents indicated little or no knowledge of the standards. They also reported that curriculum revisions in both mathematics and science most often had been made within the last four years. The revisions were guided by current trends and best practices and resulted in incorporating standards and benchmarks. A higher percentage of superintendents (75%) than teachers (about 50%) reported that adhering to the established curriculum was required.

About 60% of the superintendents reported that their districts had added mathematics courses during the last five years, staffing them through reassignment of current teachers or by having teachers teach additional periods or subjects. Forty-five percent of the superintendents reported adding science courses, again staffing them through reassignment or adding additional periods or subjects.

Superintendents and AEA coordinators reported that local standards and benchmarks have had a positive effect on both student achievement and instruction in mathematics and science. Many teachers commented that standards and benchmarks have helped them focus their teaching, made them more accountable in assessing their students, and helped them to implement a consistent curriculum with other teachers at their grade level. Conversely, a few teachers have noticed little or no effect on their teaching, citing that the

implementation of the standards and benchmarks was time consuming or encourages them to teach to tests.

Finally, there was agreement from teachers, superintendents, AEA coordinators, and higher education faculty on how the Iowa Department of Education, the AEAs, local school districts, and higher education institutions can assist teachers in incorporating mathematics and science reform into their classrooms. They suggested that providing effective and long-term professional development opportunities, providing funding for resources like substitutes, materials, technology, and mentoring programs so teachers can learn and practice reforms, more clearly defining standards, and increasing and enhancing communication and interaction with higher education institutions and AEAs would be the best ways to assist teachers.

Integrating Environmental Education

Much of the environmental education occurring in Iowa is driven by the interests of individual teachers. Despite state mandates, there are few requirements and little continuity in schools or districts or across the state. Integrating environmental education is seen to be an effective method to improve student interest and achievement.

Most of the superintendents reported that environmental education had been incorporated into the curriculum, and many thought it was an important or very important component of the curriculum. Most teachers reported that they spend some time on environmental education during the year, with one in five science teachers spending more than 10% on environmental topics. Whether this was a sufficient amount of time, teachers were split, with slightly over half indicating that it was sufficient and slightly less than half saying that it was not. Teachers also thought that professional development in incorporating environmental education into the curriculum was important, but fewer than half thought it had been adequate.

Science teachers, superintendents, AEA coordinators, and higher education faculty suggested that the Iowa Department of Education could assist them in integrating environmental education by addressing the need for materials, resources, and training; funding programs and professional development; providing information on how to integrate environmental education into other required curriculum; and developing standards and benchmarks for environmental education.

Assessment

State legislation requires that multiple assessments be used in mathematics and science, in addition to using the Iowa Test of Basic Skills (ITBS) and/or the Iowa Test of Educational Development (ITED). For mathematics, a majority of teachers and about half of the superintendents reported the use of performance assessments or a combination of selected response and performance assessments as the format of their multiple assessments. Assessments most often mentioned for mathematics included the Iowa Collaborative Assessment Modules (ICAM), Mid-Iowa Achievement Level Tests, district- and AEA-developed assessments, the New Standards Reference Exam, and NWEA.

For science, a majority of teachers and half of the superintendents reported that they use performance assessments or a combination of selected response and performance assessments as the format of their multiple assessments. Assessments most often mentioned for science included the Mid-Iowa Achievement Level Tests, PLAN/ACT, district-developed assessments, NWEA, and SCASS performance assessments.

Use of Technology

The use of technology in the classroom has increased since 1992. In 2002, 88% of teachers indicated that they use electronic communication such as email or the internet daily. However, they are not providing opportunities for their

students to use it at that same rate. Although student use has increased in the last ten years, over half use it only a few times a year or never with their students.

The frequency of use of the ICN by teachers has also increased since 1995, with double the percentage of teachers using it for professional development in 2002. About one in four teachers used the ICN to provide instructional activities for their students in 2002, twice as many as in 1995. Further, teachers in smaller districts are using the ICN more than teachers in larger districts, both for professional development activities and to provide instructional activities for their students.

In 2002, teachers recognized the importance of integrating instructional technology into mathematics and science classrooms. Forty percent of the teachers indicated that they are well prepared to integrate technology in teaching mathematics and science, and another third somewhat agreed that they are well prepared. Despite this, 13% of elementary teachers, 8% of secondary mathematics teachers, and 10% of secondary science teachers indicated a very high need for professional development in using instructional technology in teaching mathematics and science. In 1992, all groups of teachers (elementary, secondary mathematics, and secondary science teachers) reported that appropriate instructional technology was needed in the classroom for teaching mathematics and science, while, in 2002, only elementary teachers reported this need.

AEA Issues

The challenges that AEAs face, such as loss of funding and reorganization, affect the services and programs they can offer and deliver. AEA coordinators reported that they are concerned about the loss of the Eisenhower money and thought it would negatively affect the programs they provide. Over half of them were unsure how their positions would be affected with AEA mergers, but

generally anticipated that they would have additional responsibilities and would likely serve more school districts. Slightly more than half of them anticipated forming a mathematics/science consortium using new Title II funding from the districts.

The AEA coordinators suggested ways that they could work together with the Iowa Department of Education to improve mathematics and science education, including (1) coordinating statewide efforts to provide leadership in establishing collaborative goals with appropriate strategies and monitoring, (2) coordinating inservice training across the state in areas of focus, (3) supporting effective models, and (4) providing effective communication between the Department and the AEAs through sharing information at meetings and cooperative learning about effective programs, research-based instructional strategies, and recent legislation.

Teacher Supply and Demand

Over 300 superintendents provided key information about current supply and demand for mathematics and science teachers in Iowa. They anticipated hiring 509 science teachers and 539 mathematics teachers at the high school level in the next five years. Most of the new teachers will be hired to teach a combination of mathematics or science subjects. In specific subject areas, superintendents expected to hire most of the teachers for algebra, geometry, biology, chemistry, and physics. A high percentage of superintendents, more than 70%, anticipated much or a great deal of difficulty in hiring teachers for calculus, pre-calculus, trigonometry, statistics and probability, and a combination of mathematics subjects. A similar percentage of superintendents expected to have difficulty in hiring teachers for physics, chemistry, physical science, and a combination of science subjects at the high school level. Superintendents in 2002 expected to have more difficulty in hiring qualified high school teachers in both mathematics and science than they did in 1992.

At the middle school level, superintendents anticipated hiring 220 mathematics teachers and 249 science teachers in the next five years. Again, most of these positions will be filled with teachers who will teach a combination of mathematics or science subjects. About half of the superintendents expected to have much to a great deal of difficulty in hiring mathematics and science teachers at the middle school level. Consistent with the high school level, superintendents in 2002 also expected more difficulty in hiring middle school mathematics and science teachers than they did in 1992.

About 1550 available elementary teaching positions are expected in the next five years. Unlike at the secondary level, superintendents in 2002 anticipated little difficulty in filling these elementary positions.

According to the superintendents, three of four anticipated vacancies at elementary and secondary levels in both mathematics and science will be due to teacher retirements or teachers obtaining a teaching position in another district.

About half of the superintendents indicated that reform movements in mathematics and science have had little or no effect on their hiring practices. For those responding that the reform movements had affected hiring practices, several superintendents noted that they had revised their interviewing and screening processes to incorporate questions about reform, hiring teachers with experience and knowledge of standards, and changing their curricula to reflect the standards. This was consistent with superintendent responses in 1992.

Partnerships

Local school districts partner with the Iowa Department of Education, the AEAs, and Iowa's higher education institutions to enhance mathematics and science education and employ strategies to address statewide initiatives. As one of these strategies, the roles of higher education institutions and the AEAs are seen as important by all groups in providing inservice opportunities to teachers. Teachers, superintendents, and AEA coordinators also agreed that the role of

Iowa Mathematics-Science Coalition should be that of (1) serving as a clearinghouse of information and offering inservice to mathematics and science teachers on current practices and strategies, (2) providing leadership by lobbying for increased funding for education and encouraging entry into and retention in teaching mathematics and science, and (3) developing standards and assessments in mathematics and science.

Additionally, respondents considered that collaborations like the Regents Academy for Mathematics and Science (RAMS) and the Governor's Conference for Mathematics and Science Reform are beneficial. A high percentage of key educational partners, particularly the higher education faculty, indicated that they were willing to take leadership roles in seeking grant opportunities in mathematics and science.

National Initiatives—No Child Left Behind

The No Child Left Behind legislation is already having a widespread impact on mathematics and science education in Iowa. About half of the elementary and secondary mathematics teachers, superintendents, and AEA coordinators, one-third of the secondary science teachers, and over half of the higher education faculty reported that they have an adequate understanding of the law. A lesser percentage in each group indicated that they understood the law's implications for mathematics and science education.

Appendix A:
Survey Participant Letters and Notes

Fields of Opportunities

STATE OF IOWA

THOMAS J. VILSACK, GOVERNOR
SALLY J. PEDERSON, LT. GOVERNOR

DEPARTMENT OF EDUCATION
TED STILWILL, DIRECTOR

September 25, 2002

Dear Educator:

You have been selected to participate in a comprehensive "2002 Iowa Mathematics and Science Needs Assessment " for the State of Iowa. The Iowa Department of Education (DE) has contracted with the Research Institute for Studies in Education (RISE) at Iowa State University to conduct the survey. It has been ten years since such a survey was last conducted in Iowa. With recent state (HF2272) and federal legislation (No Child Left Behind), this is an opportune time to collect data that will assist school districts, Area Education Agencies (AEAs), higher education institutions, and the DE in setting direction and focus in mathematics and science education that is aligned with legislative requirements and meets the needs of our school districts. Surveys are being sent to teachers, AEA Math and Science coordinators, superintendents, and higher education faculty.

Specifically, it is intended that these needs assessment surveys provide the following:

1. Data that indicate what progress has been made in the awareness and implementation of the national math and science standards;
2. Data that can be used in school districts' needs assessments;
3. Data that address teacher quality and teacher shortage;
4. Data that can be used in improving teacher preparation programs;
5. Data that is necessary in applying for grants such as mathematics and science partnerships; and
6. Data that will help set a focus in mathematics and science education in the next five years.

Please take the time to complete this very important survey that will be vital in determining educational services for the teachers and students in Iowa. The survey will take approximately thirty minutes of your time. If you have any questions, please contact W. Tony Heiting, State Science Consultant, 515-281-3249; Judith Spitzli, State Mathematics Consultant, 515-281-3874; or Kathy McKee, State Special Needs Mathematics/Science and Environmental Education Consultant, 515-281-3146. Thank you.

Sincerely,

Ted Stilwill, Director
Iowa Department of Education

Enclosure

Fields of Opportunities

STATE OF IOWA

THOMAS J. VILSACK, GOVERNOR
SALLY J. PEDERSON, LT. GOVERNOR

DEPARTMENT OF EDUCATION
TED STILWILL, DIRECTOR

September 25, 2002

Dear Educator:

You have been selected to take part in a comprehensive "2002 Iowa Mathematics and Science Needs Assessment". The Iowa Department of Education has contracted with the Research Institute for Studies in Education (RISE) at Iowa State University to conduct the surveys. Separate surveys are being sent to AEA science and mathematics supervisors, district superintendents, and representatives from teacher education institutions.

Your input is very important to us as we determine our role in assisting teachers and school districts in the areas of mathematics and science. The information that we collect from the surveys will help us address issues such as:

- awareness and implementation of mathematics and science standards;
- providing in-service opportunities;
- teacher shortages in mathematics and science areas;
- improving teacher preparation programs; and
- setting a focus for mathematics and science education in the next five years.

Please take the time to complete this very important survey. It will take approximately thirty minutes of your time. If you have any questions, please contact W. Tony Heiting, State Science Consultant, 515-281-3249; Judith Spitzli, State Mathematics Consultant, 515-281-3874; or Kathy McKee, State Special Needs Mathematics/Science and Environmental Education Consultant, 515-281-3146. Thank you.

Sincerely,

Ted Stilwill, Director
Iowa Department of Education

Enclosure

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY
Research Institute for Studies in Education

College of Education
E005 Lagomarcino Hall
Ames, Iowa 50011
515 294-7009
FAX 515 294-9284

October 11, 2002

Dear Iowa Educator:

We need your help! Within the last two weeks you received a **"2002 Iowa Mathematics and Science Needs Assessment"** from the Iowa Department of Education. At this time, we haven't received your completed survey. We want you to know that your responses are very important to the success of this study and encourage you to send back your survey.

Teachers, superintendents, AEA math and science coordinators, and higher education faculty from all across Iowa are participating in this study. The information from the surveys will address issues such as awareness and implementation of math and science standards; providing in-service opportunities for teachers; teacher shortages in math and science areas; improving teacher preparation programs; and setting a focus for math and science education in the next five years. Results are expected by the end of December.

In this packet, you'll find another copy of the survey and a business reply envelope to return the survey to ISU. **Please complete and return the survey by October 25 or sooner.** If you have questions, don't hesitate to call either me or Evette Lang at 515-294-7009.

We look forward to receiving your survey and thank you so much for helping to determine educational services for Iowa teachers and students.

Best regards,

Mari Kemis

Mari Kemis
Program Coordinator

Iowa Teacher

You have been randomly selected to participate in the enclosed "2002 Iowa Mathematics and Science Needs Assessment" sponsored by the Iowa Department of Education. This research conducted by the Research Institute for Studies in Education (RISE) at Iowa State University is designed to provide information about knowledge and level of use of math and science standards in Iowa's K-12 classrooms. It is also designed to determine needs for Iowa's math and science teachers in the next five years. It should take you about 30 minutes to complete the survey.

While we will maintain records for completion of the research, your privacy will be maintained at all times. Your personal views, and your decision to participate, will be kept confidential. All data will be summarized and reported in the aggregate. The identification code on your survey will be used to help with follow-up mailings to those who do not respond. Your individual answers will not be shared with anyone except RISE staff who will be working with the survey results. Please do not remove this identification code because if you do so we probably will send you another mailing.

Your participation in this research is voluntary. You should not "experience any discomfort or risks" from answering any questions. If you are not sure of an answer, or prefer not to answer, just leave that answer blank. If at any time you wish to withdraw from the research, you may do so.

Please use the enclosed postage paid reply envelope to **return your completed survey and answer sheets 1 and 2 by October 7.** To be sure that your answers remain anonymous, please do not put your name or return address on your return envelope.

If you need assistance in answering any items in this survey, or if you want more information about the study, feel free to call Mari Kemis or Evette Lang at 515-294-7009. Thank you for your time and participation in this important study.

Iowa Superintendent

You have been randomly selected to participate in the enclosed "2002 Iowa Mathematics and Science Needs Assessment" sponsored by the Iowa Department of Education. This research conducted by the Research Institute for Studies in Education (RISE) at Iowa State University is designed to provide information about knowledge and level of use of math and science standards in Iowa's K-12 classrooms.

A key part of your survey is to indicate needs for Iowa's math and science teachers in the next five years. Feel free to consult with others in your district to determine responses for the sections on teacher supply and demand and curriculum revision, if needed. With all information at hand, it should take you about 30 minutes to complete the survey.

While we will maintain records for completion of the research, your privacy will be maintained at all times. Your personal views, and your decision to participate, will be kept confidential. All data will be summarized and reported in the aggregate. The identification code on your survey will be used to help with follow-up mailings to those who do not respond. Your individual answers will not be shared with anyone except RISE staff who will be working with the survey results. Please do not remove this identification code because if you do so we probably will send you another mailing.

Your participation in this research is voluntary. You should not "experience any discomfort or risks" from answering any questions. If you are not sure of an answer, or prefer not to answer, just leave that answer blank. If at any time you wish to withdraw from the research, you may do so.

Please use the enclosed postage paid reply envelope to **return your completed survey by October 7**. To be sure that your answers remain anonymous, please do not put your name or return address on your return envelope.

If you need assistance in answering any items in this survey or if you want more information about the study, feel free to call Mari Kemis or Evette Lang at 515-294-7009. Thank you for your time and participation in this important study.

AEA Mathematics or Science Coordinator

You have been randomly selected to participate in the enclosed "2002 Iowa Mathematics and Science Needs Assessment" sponsored by the Iowa Department of Education. This research conducted by the Research Institute for Studies in Education (RISE) at Iowa State University is designed to provide information about knowledge and level of use of math and science standards in Iowa's K-12 classrooms. It is also designed to determine needs for Iowa's math and science teachers in the next five years. It should take you about 30 minutes to complete the survey.

While we will maintain records for completion of the research, your privacy will be maintained at all times. Your personal views, and your decision to participate, will be kept confidential. All data will be summarized and reported in the aggregate. The identification code on your survey will be used to help with follow-up mailings to those who do not respond. Your individual answers will not be shared with anyone except RISE staff who will be working with the survey results. Please do not remove this identification code because if you do so we probably will send you another mailing.

Your participation in this research is voluntary. You should not "experience any discomfort or risks" from answering any questions. If you are not sure of an answer, or prefer not to answer, just leave that answer blank. If at any time you wish to withdraw from the research, you may do so.

Please use the enclosed postage paid reply envelope to **return your completed survey by October 7.** To be sure that your answers remain anonymous, please do not put your name or return address on your return envelope.

If you need assistance in answering any items in this survey, or if you want more information about the study, feel free to call Mari Kemis or Evette Lang at 515-294-7009. Thank you for your time and participation in this important study.

Higher Education Mathematics or Science faculty member

You have been randomly selected to participate in the enclosed "2002 Iowa Mathematics and Science Needs Assessment" sponsored by the Iowa Department of Education. This research conducted by the Research Institute for Studies in Education (RISE) at Iowa State University is designed to provide information about knowledge and level of use of math and science standards in Iowa's K-12 classrooms. It is also designed to determine needs for Iowa's math and science teachers in the next five years. It should take you about 30 minutes to complete the survey.

While we will maintain records for completion of the research, your privacy will be maintained at all times. Your personal views, and your decision to participate, will be kept confidential. All data will be summarized and reported in the aggregate. The identification code on your survey will be used to help with follow-up mailings to those who do not respond. Your individual answers will not be shared with anyone except RISE staff who will be working with the survey results. Please do not remove this identification code because if you do so we probably will send you another mailing.

Your participation in this research is voluntary. You should not "experience any discomfort or risks" from answering any questions. If you are not sure of an answer, or prefer not to answer, just leave that answer blank. If at any time you wish to withdraw from the research, you may do so.

Please use the enclosed postage paid reply envelope to **return your completed survey by October 7**. To be sure that your answers remain anonymous, please do not put your name or return address on your return envelope.

If you need assistance in answering any items in this survey or if you want more information about the study, feel free to call Mari Kemis or Evette Lang at 515-294-7009. Thank you for your time and participation in this important study.

Appendix B:
Survey Instruments

2002 IOWA MATHEMATICS AND SCIENCE NEEDS ASSESSMENT

Important directions for marking answers on the enclosed answer sheets.

- You have two answer sheets. Please start with Answer Sheet 1.
- Use a No. 2 pencil.
- Do NOT use ink or ballpoint pens.
- Make heavy black marks that fill the circle completely.
- Erase cleanly any answer you wish to change.
- Make no stray marks on the answer sheet.
- Please be sure the survey question number matches the question number on the answer sheet.

On your answer sheet, mark whether you are male or female in the box labeled SEX directly to the right of the NAME section.

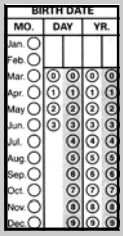
In the section labeled GRADE, use the following scale to mark the level that best describes your current teaching assignment.

0	Not currently a classroom teacher
1	Elementary only
2	Middle school/junior high only
3	High school only
4	Elementary/middle school combination
5	Middle school/high school combination
6	K-12
7	Early childhood only
8	Other

In the section labeled SPECIAL CODES, fill in the circle in column "P" to indicate which of the following subject areas you teach.

0	Mathematics
1	Science
2	Mathematics and Science

In the section labeled BIRTH DATE, fill in the circles in the two columns under "YR" to indicate how many years of teaching experience you have. For example, if you have five years of teaching experience, you would complete this section as follows:



SECTION A

Items 1-8

We are interested in your perceptions of the overall preparation of mathematics and science teachers in your district. Use this response scale to indicate your level of agreement with the following statements.

Agreement

1	2	3	4	5	6	10
Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree	Don't know

1. Elementary teachers in your district are well prepared to teach mathematics.
2. Elementary teachers in your district are well prepared to teach science.
3. Middle school/junior high teachers in your district are well prepared to teach mathematics.
4. Middle school/junior high teachers in your district are well prepared to teach science.
5. High school teachers in your district are well prepared to teach mathematics.
6. High school teachers in your district are well prepared to teach science.
7. Teachers in your district are well prepared to use instructional technology in teaching mathematics and science.
8. Teachers in your district are well prepared to incorporate environmental education into their teaching.

SECTION B

Items 9-54

Consider the following factors and rate your perception of their adequacy and importance in achieving improvement in mathematics and/or science in your school district. Use the following scales.

Adequacy

1	2	3	4	5	10
Very inadequate	Inadequate	Neutral	Adequate	Very adequate	Don't know

Importance

1	2	3	4	5	10
Very unimportant	Unimportant	Neutral	Important	Very important	No opinion

Level of funding for science and mathematics (equipment, facilities, staff)

9. Adequacy
10. Importance

Leadership/assistance from universities

11. Adequacy
12. Importance

Adequacy

1	2	3	4	5	10
Very inadequate	Inadequate	Neutral	Adequate	Very adequate	Don't know

Importance

1	2	3	4	5	10
Very unimportant	Unimportant	Neutral	Important	Very important	No opinion

Leadership/assistance from AEAs
13. Adequacy
14. Importance

Leadership/assistance from State Department of Education
15. Adequacy
16. Importance

Leadership/assistance from administrators in your building/district
17. Adequacy
18. Importance

Leadership/assistance from teachers in your building/district
19. Adequacy
20. Importance

Leadership/assistance from curriculum supervisors in your district
21. Adequacy
22. Importance

Knowledge about reform efforts in mathematics
23. Adequacy
24. Importance

Knowledge about reform efforts in science
25. Adequacy
26. Importance

Communication among educators, parents, community members, and business leaders
27. Adequacy
28. Importance

Involvement of parents, community members, and business leaders in reform efforts
29. Adequacy
30. Importance

Opportunities to participate in inservice activities in mathematics and science
31. Adequacy
32. Importance

Opportunities for reflection on own teaching
33. Adequacy
34. Importance

Opportunities to share ideas and strategies with peers
35. Adequacy
36. Importance

SECTION B (CONTINUED)

Adequacy

1	2	3	4	5	10
Very inadequate	Inadequate	Neutral	Adequate	Very adequate	Don't know

Importance

1	2	3	4	5	10
Very unimportant	Unimportant	Neutral	Important	Very important	No opinion

Articulation between levels (elementary, middle school/junior high, high school) in mathematics

37. Adequacy
38. Importance

Articulation between levels (elementary, middle school/junior high, high school) in science

39. Adequacy
40. Importance

Use of multiple assessment measures (e.g., portfolios, authentic assessment, standardized tests, criterion-referenced tests)

41. Adequacy
42. Importance

Quality of instructional materials in mathematics (textbooks, media, and manipulatives, etc.)

43. Adequacy
44. Importance

Quality of instructional materials in science (textbooks, media, and manipulatives, etc.)

45. Adequacy
46. Importance

Awareness of the uses of instructional technology in mathematics and science

47. Adequacy
48. Importance

Availability of appropriate instructional technology in the classroom for teaching mathematics and science

49. Adequacy
50. Importance

Skills to utilize appropriate instructional technology in mathematics and science

51. Adequacy
52. Importance

Strategies for encouraging participation by underrepresented groups (females, minorities, disabled) in mathematics and science

53. Adequacy
54. Importance

SECTION C

Items 55-65

We are interested in your opinions about a number of possible strategies to improve mathematics and science education. Use the following response scale to indicate your level of agreement/disagreement with the following statements.

Agreement

1	2	3	4	5	6
Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree

ARE YOU AT 55 ON YOUR ANSWER SHEET?

55. A State Clearinghouse for the dissemination of information on all local, state, and national science and mathematics education programs and activities is needed in Iowa.

56. Partnerships with the private sector are a good way to enhance mathematics and science programs in your school district.

57. Partnerships with universities are a good way to enhance mathematics and science programs in your school district.

58. Partnerships with the private sector (e.g., donated equipment, resource people) in mathematics and science often exist in your school district.

59. Partnerships with the universities (e.g., mentor programs, special projects) in mathematics and science often exist in your school district.

60. Increased instructional time in the areas of mathematics and science at the elementary levels would improve mathematics and science education in your district.

61. Requiring elementary teachers to take more mathematics and science courses at the undergraduate level would improve math and science education.

62. Requiring secondary teachers to take more mathematics and science methods courses at the undergraduate level would improve math and science education.

63. Adding environmental education strategies is a way to strengthen curriculum and improve student achievement.

64. My district needs additional funding for science and mathematics (equipment, facilities, staff).

65. Teachers in my district need more opportunities to participate in inservice activities in mathematics and/or science.

SECTION D

Items 66-93

Now we would like to ask you about your professional development needs in the following areas. Please indicate how adequately prepared you are in each of the general areas and how important professional development opportunities would be to you. Use the following scales.

Adequacy

1	2	3	4	5	10
Very inadequate	Inadequate	Neutral	Adequate	Very adequate	Don't know

Importance

1	2	3	4	5	10
Very unimportant	Unimportant	Neutral	Important	Very important	No opinion

Planning and delivering instruction
- 66. Adequacy
- 67. Importance

Selecting and organizing materials
- 68. Adequacy
- 69. Importance

Using instructional strategies such as cooperative learning and peer coaching
- 70. Adequacy
- 71. Importance

Meeting the needs of underrepresented groups in mathematics and science
- 72. Adequacy
- 73. Importance

Working with students with learning problems
- 74. Adequacy
- 75. Importance

Making accommodations for students with special needs
- 76. Adequacy
- 77. Importance

Utilizing multiple assessment measures
- 78. Adequacy
- 79. Importance

Coordinating curriculum standards and benchmarks with assessment
- 80. Adequacy
- 81. Importance

Understanding and managing behavior problems in the classroom
- 82. Adequacy
- 83. Importance

Organizing classroom learning opportunities in large-group, small-group, and individual settings
- 84. Adequacy
- 85. Importance

Using instructional technology in your classroom (e.g., computers, calculators with graphing capabilities)

86. Adequacy
87. Importance

Incorporating environmental education into the curriculum

88. Adequacy
89. Importance

Content knowledge in mathematics

90. Adequacy
91. Importance

Content knowledge in science

92. Adequacy
93. Importance

Items 94-103

Please indicate your need for professional development/inservice training in each of the following areas. Use the scale below.

Need

1	2	3	4	5
No need	Low need	Some need	High need	Very high need

ARE YOU AT 94 ON YOUR ANSWER SHEET?

94. Using instructional strategies such as cooperative learning and peer coaching

95. Using strategies to meet the needs of underrepresented groups in mathematics and science

96. Working with students with learning problems

97. Using multiple assessment measures

98. Aligning curriculum standards and benchmarks with assessment

99. Understanding and managing behavior problems in the classroom

100. Organizing classroom learning opportunities in large-group, small-group, and individual settings

101. Using instructional technology in teaching mathematics and science

102. Using the Iowa Communications Network (ICN), Iowa's fiber-optic telecommunications network

103. Using environmental education strategies to enhance curriculum

SECTION E

Items 104-108

Indicate how effective you think you have been in incorporating the following in your classroom. Use the scale below.

Effectiveness

1	2	3	4	5	6	10
Very ineffective	Ineffective	Somewhat ineffective	Somewhat effective	Effective	Very effective	Have not incorporated

104. Mathematics and/or science standards overall

105. Mathematics and/or science standards related to instructional methods

106. Mathematics and/or science standards related to curriculum changes

107. Mathematics and/or science standards related to assessment practices

108. Instructional technology

Items 109-113

Indicate how often you participate in the following activities. Use the scale below.

Frequency

1	2	3	4	5
Never	A few times a year	Monthly	Weekly	Daily

109. Use electronic communication (e.g., internet, e-mail)

110. Provide opportunities for your students to use electronic communication

111. Communicate with teachers <u>in</u> your district about recent reforms in mathematics and/or science

112 Communicate with teachers <u>outside</u> of your district about recent reforms in mathematics and/or science

113. Communicate with administrators in your school about recent reforms in mathematics and/or science

---

114. Have you used the ICN (Iowa's fiber optic network) for professional development activities (i.e., inservice, meetings, college classes)?
1 Yes 2 No

115. Have you used the ICN to provide instructional activities for your students (i.e., speakers, special events, courses)?
1 Yes 2 No

SECTION F

Items 116-119

The following questions address how you incorporate the standards into your teaching. On your answer sheet, please darken the bubble corresponding to your response.

116. How effective are demonstration classrooms in helping teachers learn how to incorporate mathematics and science standards-based reforms in their own classrooms?
- 1 Very ineffective
- 2 Ineffective
- 3 Somewhat ineffective
- 4 Somewhat effective
- 5 Effective
- 6 Very effective
- 7 No opinion

117. What kinds of reforms, consistent with the recent mathematics and/or science standards, have you incorporated in your classroom(s)?
- 1 Curriculum changes only
- 2 Assessment practices only
- 3 Instructional methods only
- 4 Both curriculum changes and assessment practices
- 5 Both curriculum changes and instructional methods
- 6 Both assessment practices and instructional methods
- 7 Curriculum changes, assessment practices, and instructional methods
- 8 Have not incorporated any reforms

118. Which of the following best describes the total amount of your inservice training in recent types of mathematics and/or science reforms such as those recommended by the National Council of Teachers of Mathematics (NCTM) and/or the National Science Education Standards?
- 1 None
- 2 1 day total
- 3 2 to 5 days total
- 4 1 to 2 weeks total
- 5 3 weeks or more total, not offered consecutively
- 6 3 consecutive weeks
- 7 3 consecutive weeks, plus additional training

119. To what extent have you applied the skills and knowledge you learned in this training in your classroom?
- 1 None
- 2 A little
- 3 Some
- 4 Quite a bit
- 5 Extensively

YOU ARE NOW FINISHED WITH YOUR FIRST ANSWER SHEET. LEAVE QUESTION NUMBER 120 ON ANSWER SHEET NUMBER 1 BLANK. PLEASE MAKE SURE YOU START WITH NUMBER 1 ON ANSWER SHEET NUMBER 2!

SECTION F (CONTINUED)

Items 1-2 (Answer Sheet 2)

Indicate how important the roles played by higher education and AEAs are in providing inservice programs for mathematics and science teachers. Use the scale below.

Importance	1	2	3	4	5	10
	Very unimportant	Unimportant	Neutral	Important	Very important	No opinion

ARE YOU AT NUMBER 1 ON ANSWER SHEET NUMBER 2?

1. How important is the role of higher education institutions in providing inservice programs in science and mathematics for teachers?

2. How important is the role of AEAs in providing inservice programs in science and mathematics for teachers?

---

3. Do you have an adequate understanding of the new federal legislation ("No Child Left Behind")?
   1 Yes 2 No

4. Do you have an adequate understanding of its implications for mathematics and science education?
   1 Yes 2 No

5. Would you be willing to take a leadership role in seeking grant opportunities (i.e., NSF, state-funded, Carver) in mathematics and science education?
   1 Yes 2 No

What do you think the major role of the Iowa Mathematics-Science Coalition should be?

_____

_____

_____

SECTION G—MATHEMATICS TEACHERS ONLY

Answer questions 6–25 if you teach mathematics as part of your regular teaching assignment. If you teach only science, skip questions 6–25 and begin answering again with SECTION H, question 26. On your answer sheet, please darken the bubble corresponding to your response.

6. Which of the following best describes your familiarity with the national mathematics standards (such as NCTM or MCREL) for <u>your</u> grade level(s)?
   1 Don't know about them
   2 Know a little about them
   3 Fairly familiar with them
   4 Very familiar with them
   5 Completely familiar with them

7. Which of the following best describes your familiarity with the national mathematics standards for all grade level(s)?
   1 Don't know about them
   2 Know a little about them
   3 Fairly familiar with them
   4 Very familiar with them
   5 Completely familiar with them

8. When did your district last complete a revision of the mathematics curriculum?
   1 Within the last year
   2 1-2 years ago
   3 3-4 years ago
   4 5 or more years ago
   5 Don't know

9. Were the national standards (i.e., NCTM) incorporated into the revision?
   1 Yes, extensively
   2 Yes, somewhat
   3 Yes, a little
   4 No
   5 Don't know

10. What is the district policy regarding adherence to the math curriculum by individual teachers?
    1 Required 2 Suggested 3 Voluntary

11. When do you expect the next revision of your district's mathematics curriculum?
    1 Currently under revision
    2 Within the next 1-2 years
    3 Within the next 3-4 years
    4 Within the next 5 or more years
    5 Don't know

12. Will the national standards (i.e., NCTM) be incorporated into that revision?
    1 Yes 2 No 3 Don't know

Items 13-16 (Answer Sheet 2)

Use this response scale to indicate your level of agreement/disagreement with the following statements.

Agreement

1	2	3	4	5	6
Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree

13. I feel well prepared to implement the NCTM standards in my classroom.

14. Reforms in mathematics have had a positive impact on student learning.

15. I need more opportunities for professional development/inservice training in content knowledge in mathematics.

16. I need more opportunities for professional development/inservice training in incorporating NCTM standards.

Items 17-21 (Answer Sheet 2)

Indicate how adequately you were prepared to teach mathematics when addressing the following topics. Use the scale below.

Adequacy

1	2	3	4	5	10
Very inadequate	Inadequate	Neutral	Adequate	Very adequate	Don't know

17. Iowa teaching standards

18. Special needs of students

19. NCTM content standards

20. NCTM process standards

21. Closing the achievement gap

How has the development of district standards and benchmarks affected your teaching and student achievement in your district?

_____

_____

_____

22. Are the current state requirements for licensure for mathematics sufficient for elementary teachers?
1 Yes 2 No 3 Don't know

23. Are the current state requirements for licensure for mathematics sufficient for middle school teachers?
1 Yes 2 No 3 Don't know

24. Are the current state requirements for licensure for mathematics sufficient for high school teachers?
1 Yes 2 No 3 Don't know

If the current state requirements are not sufficient, what would you recommend?

_____

_____

_____

25. State legislation requires that "multiple assessments" be used in mathematics and reported in 2001. Besides the Iowa Test of Basic Skills and/or the Iowa Test of Educational Development, check what best describes your second assessment (multiple assessment requirement). Please indicate title if applicable.
1 Standardized test _____
2 Selected response _____
3 Performance assessment (i.e., portfolio, constructive response) _____
4 Combination selected response/performance assessment _____
5 Other, describe _____

IF YOU ALSO TEACH SCIENCE, CONTINUE WITH SECTION H. IF NOT, PLEASE SKIP TO THE BACK COVER TO FINISH THE SURVEY.

SECTION H – SCIENCE TEACHERS ONLY

Answer questions 26-56 if you teach science as part of your regular teaching assignment. If you teach only mathematics, skip questions 26–56 and answer the questions on page 16. On your answer sheet, please darken the bubbles corresponding to your response.

ARE YOU AT 26 ON YOUR ANSWER SHEET?

26. Which of the following best describes your familiarity with the National Science Education Standards (NSES) for <u>your</u> grade level(s)?
    1 Don't know about them
    2 Know a little about them
    3 Fairly familiar with them
    4 Very familiar with them
    5 Completely familiar with them

27. Which of the following best describes your familiarity with the National Science Education Standards (NSES) for <u>all</u> grade level(s)?
    1 Don't know about them
    2 Know a little about them
    3 Fairly familiar with them
    4 Very familiar with them
    5 Completely familiar with them

28. When did your district last complete a revision of the science curriculum?
    1 Within the last year
    2 1-2 years ago
    3 3-4 years ago
    4 5 or more years ago
    5 Don't know

29. Were recommendations such as the National Science Education Standards or AAS's Project 2061 incorporated into the revision?
    1 Yes, extensively
    2 Yes, somewhat
    3 Yes, a little
    4 No
    5 Don't know

30. What is the district policy regarding adherence to the science curriculum by individual teachers?
    1 Required 2 Suggested 3 Voluntary

31. When do you expect the next revision of your district's science curriculum?
    1 Currently under revision
    2 Within the next 1-2 years
    3 Within the next 3-4 years
    4 Within the next 5 or more years
    5 Don't know

32. Will national science standards be incorporated into that revision?
    1 Yes 2 No 3 Don't know

Items 33-36 (Answer Sheet 2)

Use this response scale to indicate your level of agreement/disagreement with the following statements.

Agreement

1	2	3	4	5	6
Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly agree

33. I feel well prepared to implement in my classroom the recommendations for science reform as outlined in the National Science Education Standards.

34. Reforms in science have had a positive impact on student learning.

35. I need more opportunities for professional development/inservice training in content knowledge in science.

36. I need more opportunities for professional development/inservice training in incorporating recent recommendations for science reform.

Items 37-43 (Answer Sheet 2)

Indicate how adequately you were prepared to teach science when addressing the following topics. Use the scale below.

Adequacy

1	2	3	4	5	10
Very inadequate	Inadequate	Neutral	Adequate	Very adequate	Don't know

37. Safety concerns in the lab/classroom
38. Iowa teaching standards
39. Special needs of students
40. Inquiry-based learning
41. National Science Education Standards
42. Improving reading and writing skills through science teaching
43. Closing the achievement gap

Items 44-50 (Answer Sheet 2)

Indicate how adequately your teacher preparation program prepared you to teach the following topics. Use the adequacy scale above (from questions 37-43).

44. Biology
45. Chemistry
46. Physics
47. Earth/space science
48. Physical science
49. Life science
50. Environmental science

If not adequate, please elaborate on any improvements needed (i.e., at higher education institutions, certification, etc.).

_____

_____

_____

SECTION H—SCIENCE TEACHERS ONLY (CONTINUED)

ARE YOU AT 51 ON YOUR ANSWER SHEET?

How has the development of district standards and benchmarks affected your teaching and student achievement in your district?

_____

_____

_____

51. During a school year, what percentage of your time is spent on environmental education?
    1 None
    2 1-5%
    3 6-10%
    4 More than 10%

52. Is this a sufficient amount of time?
    1 Yes 2 No

How can the Department of Education assist you with environmental education integration?

_____

_____

53. Are the current state requirements for licensure for science sufficient for elementary teachers?
    1 Yes 2 No 3 Don't know

54. Are the current state requirements for licensure for science sufficient for middle school teachers?
    1 Yes 2 No 3 Don't know

55. Are the current state requirements for licensure for science sufficient for high school teachers?
    1 Yes 2 No 3 Don't know

If the current state requirements are not sufficient, what would you recommend?

_____

_____

56. State legislation requires that "multiple assessments" be used in science and reported in 2003. Besides the Iowa Test of Basic Skills and/or the Iowa Test of Educational Development, check what best describes your second assessment (multiple assessment requirement). Please indicate title if possible.
    1 Standardized test _____
    2 Selected response _____
    3 Performance assessment (i.e., portfolio, constructive response) _____
    4 Combination selected response/performance assessment _____
    5 Other, describe _____

SECTION I — ALL TEACHERS

Use the space provided to respond to these questions. Feel free to use additional sheets if needed.

From your perspective, what are the key teacher quality and/or teacher recruitment and retention issues that need to be addressed in science and mathematics?

What are the best ways for teachers to learn about mathematics and science reform?

What are the best ways the Department of Education, the AEAs, local school districts, and higher education institutions, can assist teachers in incorporating mathematics and science reform into their classrooms?

Return your survey answer sheets and this booklet in the enclosed envelope. If you have any questions, please call (515) 294-7009. Thank you for your responses and your time.

2002 Iowa
Mathematics & Science Needs Assessment
Superintendent Survey

We would like to ask you some questions relating to supply of and demand for mathematics and science teachers in your district. We also would like information about your district's curriculum structure and recent revisions, as well as your plans for incorporating current recommendations for reform into your mathematics and science curricula. We are also interested in your attitude about mathematics and science education and reform in Iowa.

TEACHER SUPPLY AND DEMAND

Within the next 5 years, how many mathematics and science teachers will your district need to hire at the high school, middle school/junior high, and elementary levels? Please indicate the number of teachers in each area and the level of difficulty you anticipate having in filling these positions.

High school mathematics teachers

	Number needed		No difficulty	Little difficulty	Some difficulty	Much difficulty	A great deal of difficulty	Not applicable
Algebra	_____	.....	❑	❑	❑	❑	❑	❑
Geometry	_____	.....	❑	❑	❑	❑	❑	❑
Statistics and Probability	_____	.....	❑	❑	❑	❑	❑	❑
Calculus	_____	.....	❑	❑	❑	❑	❑	❑
Pre-Calculus	_____	.....	❑	❑	❑	❑	❑	❑
Trigonometry	_____	.....	❑	❑	❑	❑	❑	❑
Combination of mathematics subjects	_____	.....	❑	❑	❑	❑	❑	❑
Other (specify below)	_____	.....	❑	❑	❑	❑	❑	❑

_____ Total number of high school mathematics teachers needed

High school science teachers

	Number needed	No difficulty	Little difficulty	Some difficulty	Much difficulty	A great deal of difficulty	Not applicable
Biology	_____	❑	❑	❑	❑	❑	❑
Chemistry	_____	❑	❑	❑	❑	❑	❑
Earth Science	_____	❑	❑	❑	❑	❑	❑
General Science	_____	❑	❑	❑	❑	❑	❑
Physical Science	_____	❑	❑	❑	❑	❑	❑
Physics	_____	❑	❑	❑	❑	❑	❑
Combination of science subjects	_____	❑	❑	❑	❑	❑	❑
Other (specify below)	_____	❑	❑	❑	❑	❑	❑

_____ Total number of high school science teachers needed

Of the total number of <u>high school</u> mathematics and science teachers needed, how many vacant positions were due to:

	High School Mathematics	High School Science
Position(s) added because of increased student population	_____	_____
Position(s) added because of increased number of course offerings	_____	_____
Teacher(s) obtaining a non-teaching position within the district or in another district	_____	_____
Teacher(s) obtaining another teaching position outside of the district	_____	_____
Teacher(s) leaving teaching for another career	_____	_____
Teacher retirement	_____	_____
Other (please specify _____)	_____	_____
Don't know	_____	_____

Middle school/junior high mathematics teachers

	Number needed		No difficulty	Little difficulty	Some difficulty	Much difficulty	A great deal of difficulty	Not applicable
General Mathematics . .	_____	. . . . .	❑	❑	❑	❑	❑	❑
Pre-algebra/Algebra . . .	_____	. . . . .	❑	❑	❑	❑	❑	❑
Combination of mathematics subjects . .	_____	. . . . .	❑	❑	❑	❑	❑	❑
Other (specify below) .	_____	. . . . .	❑	❑	❑	❑	❑	❑

_____Total number of middle school/junior high mathematics teachers needed

Middle school/junior high science teachers

	Number needed							
Life Science	_____	. . . . .	❑	❑	❑	❑	❑	❑
Earth Science	_____	. . . . .	❑	❑	❑	❑	❑	❑
Physical Science	_____	. . . . .	❑	❑	❑	❑	❑	❑
General Science	_____	. . . . .	❑	❑	❑	❑	❑	❑
Combination of science subjects	_____	. . . . .	❑	❑	❑	❑	❑	❑
Other (specify below) .	_____	. . . . .	❑	❑	❑	❑	❑	❑

_____ Total number of middle school/junior high science teachers needed

Of the total number of <u>middle school/junior high</u> mathematics and science teachers needed, how many vacant positions are due to:

	Middle school/junior high mathematics		Middle school/junior high science
Position(s) added because of increased student population	_____	. . . . .	_____
Position(s) added because of increased number of course offerings	_____	. . . . .	_____
Teacher(s) obtaining a non-teaching position within the district or in another district	_____	. . . . .	_____
Teacher(s) obtaining another teaching position outside of the district	_____	. . . . .	_____
Teacher(s) leaving teaching for another career	_____	. . . . .	_____
Teacher retirement	_____	. . . . .	_____
Other (please specify _____)	_____	. . . . .	_____
Don't know	_____	. . . . .	_____

Elementary (K-6)

	Number needed	No difficulty	Little difficulty	Some difficulty	Much difficulty	A great deal of difficulty	Not applicable
Number of elementary teachers needed in the next 5 years	_____	❑	❑	❑	❑	❑	❑

Of the total number of elementary teachers needed, how many vacant positions were due to:

Position(s) added because of increased student population ..... _____

Position(s) added because of increased number of course offerings ..... _____

Teacher(s) obtaining a non-teaching position within the district or in another district _____

Teacher(s) obtaining another teaching position outside of the district ..... _____

Teacher(s) leaving teaching for another career ..... _____

Teacher retirement ..... _____

Other (please specify _____) ..... _____

Don't know ..... _____

In your district, how many mathematics and science teachers are currently teaching outside their areas of endorsement? ..... _____

How many minority teachers are in your school district?

number of male minority teachers ..... _____

number of female minority teachers .... _____

number of minority elementary teachers . _____

number of minority secondary teachers .. _____

Please describe how recent curriculum reform movements in mathematics and science [such as those recommended by the National Council of Teachers of Mathematics (NCTM), the National Science Education Standards (NSES), and the American Association for the Advancement of Science (AAAS)], have affected hiring practices in your district. Use the space below.

CURRICULUM STRUCTURE AND REVISION

We would like information about your district's curriculum structure for mathematics and science, when you last completed a revision of your curriculum, plans for the next revision, and your familiarity with current reform efforts in mathematics and science. Please answer all questions in both sections.

Mathematics Curriculum

In the last 5 years, has your district added any **mathematics** courses?

❑ Yes ❑ No

If yes, were the additions due to:

❑ Hiring of more mathematics teachers
❑ Current teachers teaching additional periods/subjects
❑ Reassignment of current teachers
❑ Participation in whole-grade sharing
❑ Reorganized/consolidated district
❑ Other: _____

Is your district departmentalized in mathematics at the elementary level?

❑ Yes ❑ No

If yes, which grades? _____

If no, is departmentalization a goal of your district?

❑ Yes ❑ No

Which of the following best describes YOUR familiarity with national mathematics standards (such as NCTM or MCREL)?

❑ Don't know about them
❑ Know little about them
❑ Fairly familiar with them
❑ Very familiar with them
❑ Completely familiar with them

When did your district last complete a revision of the mathematics curriculum?

	Year of revision
Elementary	_____
Middle school/junior high	_____
High school	_____

What did your district do to revise the mathematics curriculum?

Were the national mathematics standards incorporated in your revision?

❑ Yes, extensively ❑ Yes, somewhat ❑ Yes, a little ❑ No ❑ Don't know

What is the district policy regarding adherence to the mathematics curriculum by individual teachers?

❑ Required ❑ Suggested ❑ Voluntary

When do you expect the next revision of your district's mathematics curriculum?

❑ 1-2 years ❑ 3-4 years ❑ 5 or more years ❑ Don't know

Science Curriculum

In the last 5 years, has your district added any **science** courses?

❑ Yes ❑ No

If yes, were the additions due to:

❑ Hiring of more science teachers
❑ Current teachers teaching additional periods/subjects
❑ Reassignment of current teachers
❑ Participation in whole-grade sharing
❑ Reorganized/consolidated district
❑ Other: _____

Is your district departmentalized in science at the elementary level?

❑ Yes ❑ No

If yes, which grades? _____

If no, is departmentalization a goal of your district?

❑ Yes ❑ No

Which of the following best describes YOUR familiarity with national science standards [such as National Science Education Standards (NSES)]?

❑ Don't know about them
❑ Know little about them
❑ Fairly familiar with them
❑ Very familiar with them
❑ Completely familiar with them

When did your district last complete a revision of the science curriculum?

	Year of revision
Elementary	_____
Middle school/junior high	_____
High school	_____

What did your district do to revise the science curricula?

Were recommendations of the AAAS's Project 2061 or National Science Education Standards (NSES) incorporated into that revision?

❑ Yes, extensively ❑ Yes, somewhat ❑ Yes, a little ❑ No ❑ Don't know

What is the district policy regarding adherence to the science curriculum by individual teachers?

❑ Required ❑ Suggested ❑ Voluntary

When do you expect the next revision of your district's science curriculum?

❑ 1-2 years ❑ 3-4 years ❑ 5 or more years ❑ Don't know

OPINIONS ABOUT IMPROVING MATHEMATICS AND SCIENCE

Now we would like to ask you about a number of situational and personal factors related to improvement in mathematics and science.

First, please rate the adequacy of the factor in your school district. Second, indicate how important the factor is in achieving improvement in mathematics and/or science.

	Very inadequate	Inadequate	Neutral	Adequate	Very adequate	Don't know	Very unimportant	Unimportant	Neutral	Important	Very important	No opinion
Level of funding for science and mathematics (equipment, facilities, staff)	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Leadership/ assistance from universities	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Leadership/ assistance from AEAs	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Leadership/ assistance from State Department of Education	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Leadership/ assistance from administrators in your district	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Leadership/ assistance from teachers in your district	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Leadership/assistance from curriculum supervisors in your district	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Knowledge about reform efforts in mathematics	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Knowledge about reform efforts in science	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Communication among educators, parents, community members, and business leaders	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Involvement of parents, community members, and business leaders in reform efforts	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Opportunities for teacher inservice activities in mathematics and science	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Opportunities for teachers to reflect on own teaching	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑

	Very inadequate	Inadequate	Neutral	Adequate	Very adequate	Don't know	Very unimportant	Unimportant	Neutral	Important	Very important	No opinion
Opportunities for teachers to share ideas and strategies with peers . . .	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Articulation between levels (elementary, middle school/junior high, high school) in mathematics and science	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Use of multiple assessment measures (e.g., authentic assessment, standardized tests, portfolios, criterion-referenced tests)	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Quality of instructional materials in mathematics (textbooks, media, manipulatives, etc.)	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Quality of instructional materials in science (textbooks, media, manipulatives, etc.)	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Teacher awareness of the uses of instructional technology in mathematics and science	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Availability of appropriate instructional technology in the classroom for teaching mathematics and science	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Teachers' skills in utilizing appropriate instructional technology in mathematics and science	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Strategies for encouraging participation by underrepresented groups (females, minorities, disabled) in mathematics and science	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑

Finally, schools are important partners in state initiatives. Your understanding and opinions of issues are key in developing strategies to address these issues.

	Positively affected	Negatively affected	No effect
How has the development of local standards and benchmarks in your district affected student achievement in mathematics?	❑	❑	❑
How has the development of local standards and benchmarks in your district affected student achievement in science?	❑	❑	❑
How has the development of local standards and benchmarks in your district affected instructional practices in mathematics?	❑	❑	❑
How has the development of local standards and benchmarks in your districts affected instructional practices in science?	❑	❑	❑

	Yes	No
Do you have an adequate understanding of the new federal legislation ("No Child Left Behind")?	❑	❑
Do you have an adequate understanding of its implications for mathematics and science education?	❑	❑
Would you be willing to take a leadership role in seeking grant opportunities (e.g., NSF, State, Carver) in science and/or mathematics education?	❑	❑
If given the opportunity, would your district participate in an AEA or LEA Consortium?	❑	❑

State legislation requires that "multiple assessments" be used in mathematics and reported in 2001. Besides the Iowa Test of Basic Skills and /or the Iowa Test of Educational Development, check what best describes your planned second assessment. Please indicate title of the test, if applicable.

- ❑ standardized test _____
- ❑ selected response _____
- ❑ performance assessment (e.g., portfolio, constructive response) _____
- ❑ combination selected response/performance assessment _____
- ❑ Other: _____

State legislation requires that "multiple assessments" be used in science and reported in 2003. Besides the Iowa Test of Basic Skills and /or the Iowa Test of Educational Development, check what best describes your planned second assessment. Please indicate the title of the test, if applicable.

- ❑ standardized test _____
- ❑ selected response _____
- ❑ performance assessment (e.g., portfolio, constructive response) _____
- ❑ combination selected response/performance assessment _____
- ❑ Other: _____

What do you think the major role of the Iowa Mathematics-Science Coalition should be?

How important is the role of AEAs in providing inservice programs in mathematics and science for teachers?

❑ Not important at all ❑ Somewhat important ❑ Important ❑ Very important

How important is role of higher education institutions in providing inservice programs in mathematics and science for teachers?

❑ Not important at all ❑ Somewhat important ❑ Important ❑ Very important

Is environmental education incorporated into your district's curriculum?

❑ Yes ❑ No

Rate the importance of environmental education in your curriculum.

❑ Not important at all ❑ Somewhat important ❑ Important ❑ Very important

How can the Department of Education assist you with environmental education integration?

What percentage of your new Title II allocation for 2002-03 will you set aside for math and science teachers' professional development?

❑ below 10% ❑ 10-25% ❑ 25-40% ❑ above 40%

If you allocated Title II money for professional development, which of the following mathematics and science activities do you have planned for your district? (Check all that apply)

_____ Mentoring
_____ Teacher collaboration
_____ Math/Science workshops
_____ Enhancing the content background
_____ Working with AEA Math/Science Coordinator in planning activities
_____ Sending teachers to science/math conferences
_____ Aligning standards/benchmarks with assessments
_____ Other: _____

Use the space provided to respond to these questions. Feel free to use additional sheets if needed.

From your perspective, what are the key teacher quality and/or teacher recruitment and retention issues that need to be addressed in mathematics and science?

What are the best ways for teachers to learn about mathematics and science reform?

What are the best ways the Department of Education, the AEAs, local school districts, and higher education institutions can assist teachers in incorporating mathematics and science reform into their classrooms?

Return your survey in the enclosed envelope. If you have any questions, please call (515) 294-7009. Thank you for your responses and your time.

2002 Iowa
Mathematics & Science Needs Assessment
Area Education Agency Version

We'd like to know what you think about professional development for K-12 teachers in mathematics and science.

In the past, the Regent's higher education program for professional development focused on establishing model classrooms and developing teams of teacher leaders in mathematics and science. Please rank-order the focus you would like higher education institutions to have in mathematics/science professional development in the next five years. Please rank the top three with 1 as your first preference, 2 as your second preference, and 3 as your third preference.

_____Enhancing content of mathematics/science teachers
_____Developing teacher leader teams for mathematics/science in school districts
_____Aligning standards and benchmarks with assessments
_____Working with students of special needs in mathematics/science
_____Implementing the national science and mathematics standards into your district's curriculum
_____Incorporating inquiry-based learning in mathematics and science
_____Improving student achievement using the environment as an integrating context for learning (EIC model)
_____Other (please specify) _____

What are the best ways teachers learn about mathematics and science reform?

In the next three years, what do you feel should be the major focus for professional development in mathematics education?

In the next three years, what do you feel should be the major focus for professional development in science education?

Next, your opinion about the roles of AEAs and others in state-wide education initiatives is important.

	Positively affected	Negatively affected	No effect
How has the development of local standards and benchmarks in your districts affected student achievement in mathematics?	❑	❑	❑
How has the development of local standards and benchmarks in your districts affected student achievement in science?	❑	❑	❑
How has the development of local standards and benchmarks in your districts affected instructional practices in mathematics?	❑	❑	❑
How has the development of local standards and benchmarks in your districts affected instructional practices in science?	❑	❑	❑

How important is the role of AEAs in providing inservice programs in mathematics and science for teachers?

- ❑ Not important at all
- ❑ Somewhat important
- ❑ Important
- ❑ Very important

How important is the role of higher education institutions in providing inservice programs in mathematics and science for teachers?

- ❑ Not important at all
- ❑ Somewhat important
- ❑ Important
- ❑ Very important

Do your future plans include forming a math/science consortium using new Title II funding from districts?

- ❑ Yes
- ❑ No

How concerned are you that the loss of the Eisenhower money will negatively impact you as mathematics/science coordinator and the programs you provide?

- ❑ Not concerned at all
- ❑ Somewhat concerned
- ❑ Very concerned

What are the most effective ways for the AEAs and the DE to work together to improve mathematics and science education?

Finally, AEAs are important partners in state initiatives. Your understanding and opinions of issues are key in developing strategies to address these issues.

How many times annually should there be a mathematics/science supervisors meeting coordinated by the DE? ..... _____

How many times annually should AEA mathematics and science coordinators meet separately (not necessarily coordinated by the DE)? ..... _____

If reorganization occurs in your AEA (with other AEAs), how will your position be affected?

	Yes	No
Would you be willing to take a leadership role in seeking grant opportunities (i.e., NSF, state-funded, Carver) in mathematics and science education?	❑	❑
Do you have an adequate understanding of the new federal legislation ("No Child Left Behind")?	❑	❑
Do you have an adequate understanding of its implications for mathematics and science education?	❑	❑
Do you believe that a collaboration (like the Regents Academy of Mathematics and Science-RAMS) of universities, private and community colleges, AEAs, and the Department of Education is beneficial?	❑	❑
Do you think it should be continued?	❑	❑

If yes, what topics should be covered in future academies?

	Yes	No
Would you like to see the Governor's Conference for Mathematics and Science Reform continued annually?	❑	❑

If the Governor's Conference is continued, what should be the emphasis at the next conference?

❑ Content ❑ Instruction ❑ Assessment

❑ Other: _____

From your perspective, what are the key teacher quality and/or teacher recruitment and retention issues that need to be addressed in mathematics and science?

How can the Department of Education assist you with environmental education integration?

What do you think the major role of the Iowa Mathematics-Science Coalition should be?

What are the best ways the Department of Education, the AEAs, local school districts, and higher education institutions can assist teachers in incorporating mathematics and science reform into their classrooms?

Return your survey in the enclosed envelope. If you have any questions, please call (515) 294-7009. Thank you for your responses and your time.

2002 Iowa
Mathematics & Science Needs Assessment
Higher Education Version

We'd like to know what you think about professional development for K-12 teachers in mathematics and science.

In the past, the Regent's higher education program for professional development focused on establishing model classrooms and developing teams of teacher leaders in mathematics and science. Please rank-order the focus you would like higher education institutions to have in mathematics/science professional development in the next five years. Please rank the top three with 1 as your first preference, 2 as your second preference, and 3 as your third preference.

_____Enhancing content of mathematics/science teachers
_____Developing teacher leader teams for mathematics/science in school districts
_____Aligning standards and benchmarks with assessments
_____Working with students of special needs in mathematics/science
_____Implementing the national science and mathematics standards into your district's curriculum
_____Incorporating inquiry-based learning in mathematics and science
_____Improving student achievement using the environment as an integrating context for learning (EIC model)
_____Other (please specify) _____

Next, we'd like to know about your teacher preparation programs in mathematics and science.

	Very inadequate	Inadequate	Neutral	Adequate	Very adequate	Don't know
How adequately does your institution prepare elementary education majors to teach mathematics?	❑	❑	❑	❑	❑	❑
How adequately does your institution prepare elementary education majors to teach science?	❑	❑	❑	❑	❑	❑
How adequately does your institution prepare secondary mathematics education majors?	❑	❑	❑	❑	❑	❑

In teaching preparation for mathematics, how adequately does your institution address the following topics?

Iowa teaching standards	❑	❑	❑	❑	❑	❑
Special needs of students	❑	❑	❑	❑	❑	❑
NCTM content standards	❑	❑	❑	❑	❑	❑
NCTM process standards	❑	❑	❑	❑	❑	❑
Closing the achievement gap	❑	❑	❑	❑	❑	❑

How adequately does your institution prepare secondary <u>science</u> education majors to teach the following courses?

	Very inadequate	Inadequate	Neutral	Adequate	Very adequate	Don't know
Biology	❑	❑	❑	❑	❑	❑
Chemistry	❑	❑	❑	❑	❑	❑
Physics	❑	❑	❑	❑	❑	❑
Earth/space science	❑	❑	❑	❑	❑	❑
Physical science	❑	❑	❑	❑	❑	❑
Life science	❑	❑	❑	❑	❑	❑
Environmental science	❑	❑	❑	❑	❑	❑

If not adequate, please suggest improvements (i.e., at higher education institutions, certification, etc.)

In teaching preparation for <u>science</u>, how adequately does your institution address the following topics?

Safety concerns in the lab/classroom	❑	❑	❑	❑	❑	❑
Iowa teaching standards	❑	❑	❑	❑	❑	❑
Special needs of students	❑	❑	❑	❑	❑	❑
Inquiry-based learning	❑	❑	❑	❑	❑	❑
National Science Education Standards	❑	❑	❑	❑	❑	❑
Improving reading and writing skills through science teaching	❑	❑	❑	❑	❑	❑
Closing the achievement gap	❑	❑	❑	❑	❑	❑
Incorporating environmental education strategies into the curriculum	❑	❑	❑	❑	❑	❑

In addition to student teaching, how much time do your pre-service mathematics and science students spend in practicum experiences before completing their teacher preparation program?

- ❑ 0-4 weeks
- ❑ 5-8 weeks
- ❑ 9-12 weeks
- ❑ 10-15 weeks
- ❑ more than 15 weeks

Do the state requirements for teacher licensure drive your teacher preparation program in mathematics and science?

- ❑ Yes
- ❑ No

How important is the role of AEAs in providing inservice programs in mathematics and science for teachers?

- ❑ Not important at all
- ❑ Somewhat important
- ❑ Important
- ❑ Very important

How important is the role of higher education institutions in providing inservice programs in mathematics and science for teachers?

- ❑ Not important at all
- ❑ Somewhat important
- ❑ Important
- ❑ Very important

Are the current state requirements for licensure for <u>science</u> sufficient for...	Yes	No	Don't know
elementary teachers?	❑	❑	❑
middle school teachers?	❑	❑	❑
high school teachers?	❑	❑	❑

If the current state requirements are not sufficient, what would you recommend?

Are the current state requirements for licensure for <u>mathematics</u> sufficient for...	Yes	No	Don't know
elementary teachers?	❑	❑	❑
middle school teachers?	❑	❑	❑
high school teachers?	❑	❑	❑

If the current state requirements are not sufficient, what would you recommend?

Does your institution keep track of the number of mathematics and science teacher education graduates that leave Iowa after graduation?

❑ Yes ❑ No

Based on whatever information you have, approximately what percentage do you think leave the state annually? . . . . . _____

How can the Department of Education assist you with environmental education integration?

	Yes	No
Would you be willing to take a leadership role in seeking grant opportunities (i.e., NSF, state-funded, Carver) in mathematics and science education?	❑	❑
Do you have an adequate understanding of the new federal legislation ("No Child Left Behind")?	❑	❑
Do you have an adequate understanding of its implications for mathematics and science education?	❑	❑
Do you believe that a collaboration (like the Regents Academy of Mathematics and Science-RAMS) of universities, private and community colleges, AEAs, and the Department of Education is beneficial?	❑	❑
Do you think it should be continued?	❑	❑

If yes, what topics should be covered in future academies?

In the next three to five years, the strength of the mathematics programs at your institution will

❑ increase ❑ decrease ❑ stay the same

To what do you attribute changes, if any?

In the next three to five years, the strength of the science programs at your institution will

❑ increase ❑ decrease ❑ stay the same

To what do you attribute changes, if any?

What are the best ways teachers learn about mathematics and science reform?

What are the best ways the Department of Education, the AEAs, local school districts, and higher education institutions can assist teachers in incorporating mathematics and science reform into their classrooms?

Return your survey in the enclosed envelope. If you have any questions, please call (515) 294-7009. Thank you for your responses and your time.

Appendix C:
Map of the AEAs

IOWA'S AREA EDUCATION AGENCIES